# THE JOURNAL OF GAS LIGHTING
## WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXIII. No. 2105.] LONDON, SEPTEMBER 15, 1903. [55TH YEAR. PRICE 6d.



**PARKER & LESTER,**

— *ESTABLISHED 1830* —

MANUFACTURERS AND CONTRACTORS, **ORMSIDE STREET, LONDON, S.E.**

THE ONLY MAKERS OF

**PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH.**

OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

**SAFETY GAS-MAIN STOPPER,**

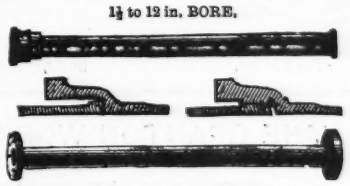
FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.

**GAS-LEAK INDICATOR.**

PRICES AND PARTICULARS ON APPLICATION.

**GAS AND WATER PIPES**

1¼ to 12 in. BORE.



**THOMAS ALLAN & SONS,** LIMITED,

**Bonlea Foundry,**

THORNABY-ON-TEES.

Formerly Springbank Iron-Works, Glasgow.

ESTABLISHED 1848.

Also Manufacturers of

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES And GENERAL CASTINGS.

Telegrams: "BONLEA, THORNABY-ON-TEES."

**NORTON'S PATENT**

# "ABYSSINIAN" & ARTESIAN TUBE WELLS,

FOR TOWN WATER-WORKS AND OTHER SUPPLIES.

The following Town Water-Works Supplies have been obtained by this System, viz. :—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.

**LE GRAND & SUTCLIFF,**

HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

**If you want the Best**

**BREEZE FURNACE,**

**REFUSE DESTRUCTOR,**

OR

**STOKER,**

*WRITE TO*

# MELDRUM

TIMPERLEY, MANCHESTER,

AND

66, VICTORIA STREET, WESTMINSTER.

**12,000** WORKING.

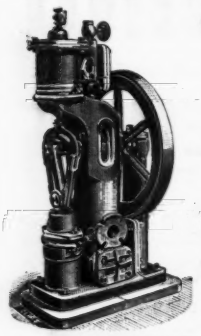
# JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

Telegrams: "Evans, Wolverhampton." London Address: Salisbury House, London Wall, London, E.C. National Telephone: No. 7039.

12,000 PUMPS IN STOCK AND PROGRESS.

TRADE MARK.

Please apply for Catalogue No. 8.



705. "SINGLE RAM" STEAM-PUMP.

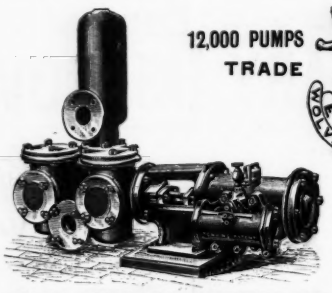


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

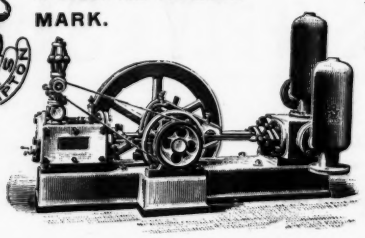


Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

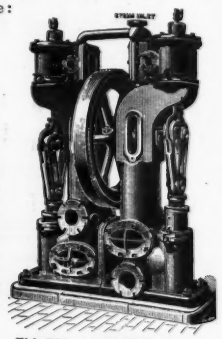


Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

## THE GRANTON WORKS, EDINBURGH AND LEITH GAS COMMISSIONERS.

PLANT HOUSE.

The whole of the Machinery in this House, which includes Patent "NEW" SCRUBBER-WASHERS, MIXING TANKS, and WATER COOLERS for the extraction of Ammonia and Cyanide, Patent PELOUZE and AUDOUIN CONDENSERS, together with all 30-inch Valves, Connections, &c.

Supplied and Erected by **W. C. HOLMES & CO., LONDON & HUDDERSFIELD.**

*HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS*

**—11 MEDALS.—**

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

**WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.**

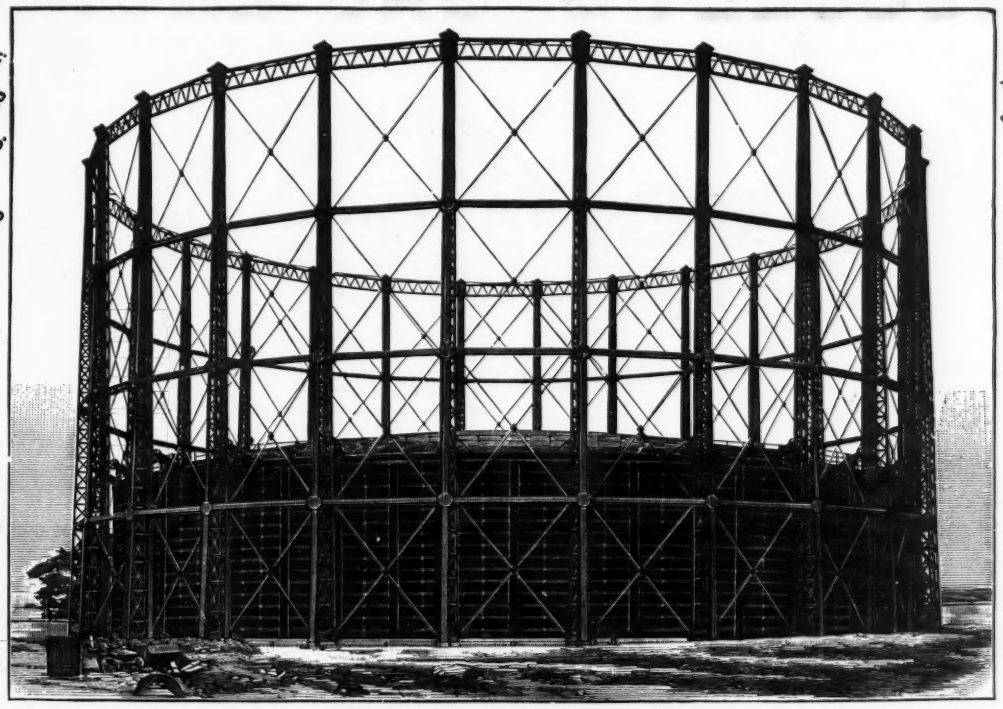
SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

**LONDON:** 106, Southwark Street. **MANCHESTER:** 33, King Street West. **BIRMINGHAM:** 114, Colmore Row. **LEEDS:** 6, Mark Lane, New Briggate.

# THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT. FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM

WELDED & RIVETED PIPES, FOUL MAINS, RETORT. LIDS, WROT & CAST TANKS, PURIFIERS.

MANUFACTURERS OF

## Humphreys & Glasgow's Patent Carburetted Water-Gas Plant.

INSTALLATIONS HAVE ALREADY BEEN ADOPTED WITH AN AGGREGATE CAPACITY OF **136,700,000** CUB. FT. DAILY.

# THE WIGAN COAL & IRON CO., LIMTD.,

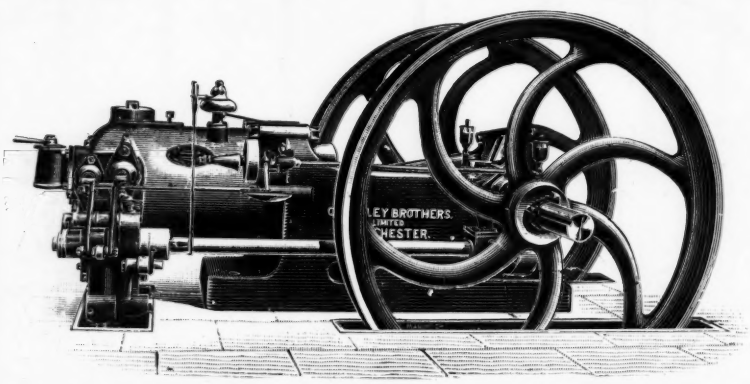
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.*
Telegraphic Address: "PARKER LONDON."

# CROSSLEY'S GAS-ENGINES

**SUITABLE FOR DRIVING EXHAUSTERS, PUMPS, &c.**



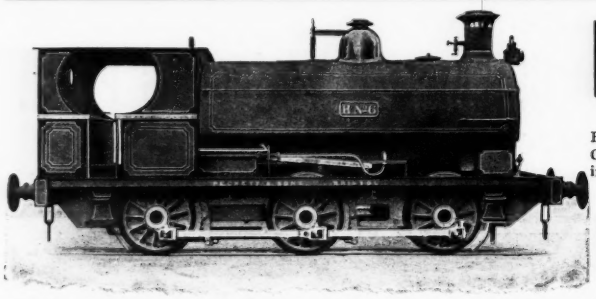

Represents "XA" Type giving 60 Effective Horse Power.

ENGINES DELIVERED—Up to the end of 1902, 46,150 Engines have been delivered representing 648,421 B. HP.

IMMEDIATE DELIVERY FOR STOCK SIZES OF ENGINES.

**Large Number of Second-Hand Engines always in Stock.**

## CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.



# LOCOMOTIVES

LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate Delivery.

**Photographs, Specifications, and Prices on Application.**

## PECKETT & SONS, Atlas Locomotive Works, BRISTOL.

Telegraphic Address: "PECKETT, BRISTOL."

# NEWTON, CHAMBERS, & CO.,

LIMITED,

*THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.*

**Established 1790**

LONDON OFFICE: **19, Great George Street, WESTMINSTER.**

Telegraphic Addresses: "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."

## GAS ENGINEERS, IRONFOUNDERS, & CONTRACTORS.

*MANUFACTURERS OF EVERY DESCRIPTION OF*

PLANT, APPARATUS, AND MACHINERY FOR GAS AND CHEMICAL WORKS.
RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS.
IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS AND ELEVATORS,
CONDENSERS, SCRUBBERS, AND WASHERS.

**PURIFIERS with Planed Joints a Speciality.**

PATENT CENTRE-VALVES, RACK AND SCREW VALVES, WOOD GRIDS, AND
SCRUBBER-BOARDS, CAST-IRON MAINS, AND SPECIALS.
STRUCTURAL WORK, COLUMNS, GIRDERS, AND ROOFING.
GASHOLDERS CAST-IRON OR STEEL TANKS.

*DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.*

**PIG IRON (SPECIAL QUALITY) for Engine Cylinders. GAS COAL famous for its unrivalled excellence.**

# THE WELSBACH KERN SELF-INTENSIFYING SYSTEM.

No. 604.

No. 35a.

The name **Welsbach** is our guarantee of quality, and a protection against disappointing results.

35a **SHADOWLESS LANTERN (500 in use in NEWCASTLE-ON-TYNE).**

604 **SUSPENSION S.I. LAMP (Interior Lighting). Enamelled throughout—No Paint used.**

Both Lamps are produced in three sizes, giving about

150 Candle Power for 5 feet of Gas per hour.
300 " " " 10 " " " "
600 " " " 20 " " " "

*Write for Catalogue of New Patterns.*

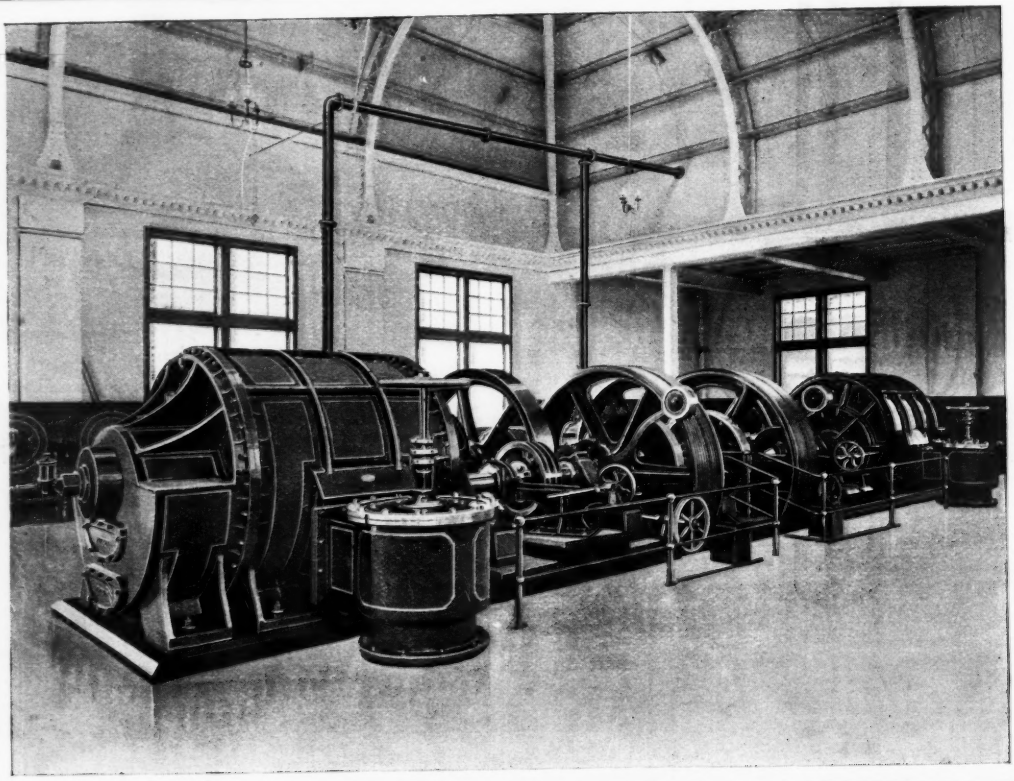
**THE WELSBACH INCANDESCENT GAS-LIGHT CO., LTD.** (AND REDUCED)

14, PALMER STREET, WESTMINSTER, S.W.

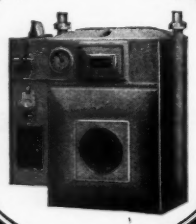
Telegrams: "Welsbach," London. Telephone: 290 Westminster.

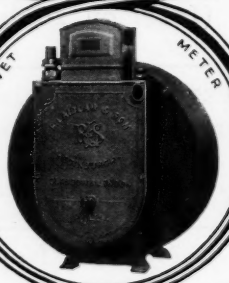
# R. LAIDLAW & SON, LIMITED

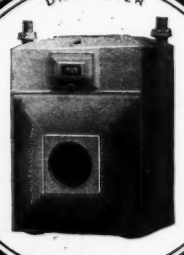
## GAS & WATER ENGINEERS.



TWO EXHAUSTERS EACH TO PASS 750000 CUB. FT. PER HOUR AT 60 REVOLUTIONS PER MINUTE DRIVEN BY TWO GAS ENGINES AND INTERMEDIATE FRICTIONAL GEARING ERECTED AT GRANTON GAS WORKS FOR EDINBURGH & LEITH GAS COMMISSIONERS.




SIMON SQUARE WORKS. EDINBURGH.

ALLIANCE FOUNDRY & ENGINEERING WORKS. GLASGOW.

6 LITTLE BUSH LANE. LONDON. E.C.

"Triumphs of Skill."

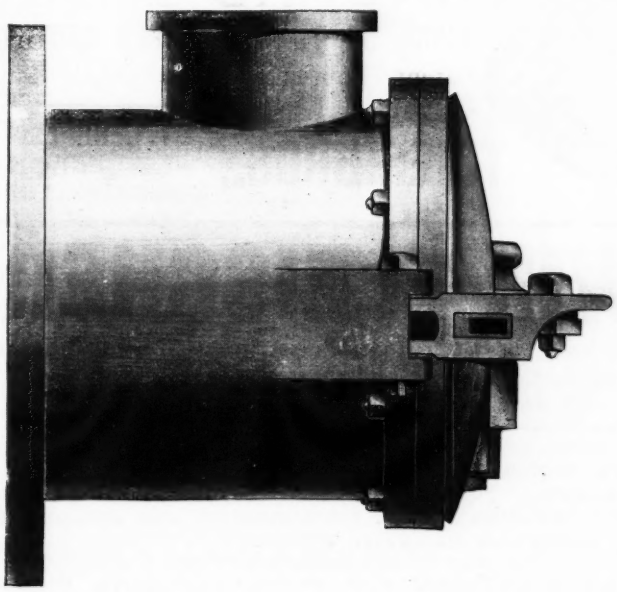
"ACME" Gas-Stoves.

Arden Hill & Co., Birmingham.

THE WHESSOE FOUNDRY CO., LTD.

Works: DARLINGTON.

MAKERS OF EVERY DESCRIPTION OF GAS PLANT.



CHANDLER'S (PATENT) "DETACHABLE FACE MOUTHPIECE"

Steel or Malleable Face.

Easily removed and replaced.

*Any Design or Shape.*

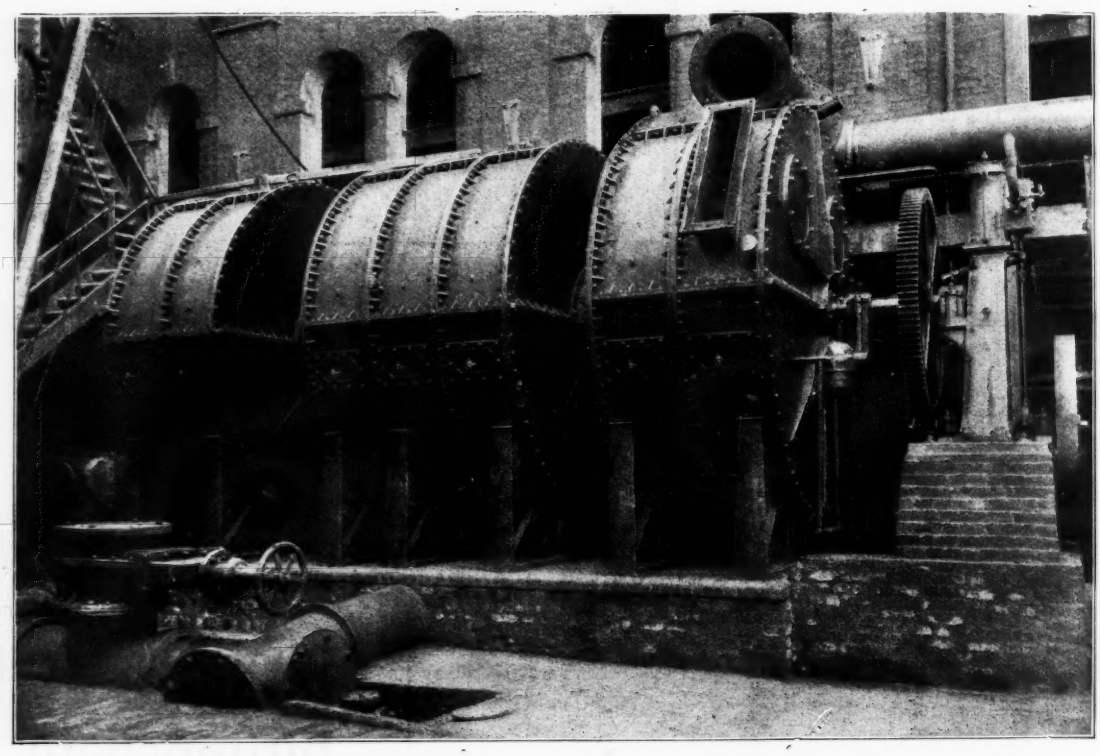
*Sole Agents and Manufacturers*

London Office: 106, CANNON STREET, E.C.

# KIRKHAM, HULETT, & CHANDLER, LTD.,

PALACE CHAMBERS, BRIDGE ST. WESTMINSTER, S.W.

Extracts ALL the Ammonia and large proportion of $CO_2$ and $H_2S$.



Maximum Washing Surface. Easy access to Bearings and Interior.

IMPROVED PATENT "STANDARD" WASHER-SCRUBBER.

Telegraphic Address: "WASHER, LONDON."

Telephone No. 127 VICTORIA.

---

"

*A BOON TO MASTER, MAN, and MACHINE.*

# TAUFFER'S LUBRICANT"

REG. TRADE MARK.

CENTIGRADE FOR HOT PLACES

TANDARD MACHINE GREASE.

AVING UP TO 90 PER CENT. OVER LIQUID OIL.

Patent "Unbreakable" & "Telltale" Stauffer Lubricators.

ENGLISH PRODUCTS.

SOLE MAKERS—

TRIER BROS., 1, GT. GEORGE ST., WESTMINSTER, LONDON.

CUMBERLAND WORKS, NEW CHURCH RD., CAMBERWELL.

---

# THE DELLWIK-FLEISCHER WATER-GAS PROCESS

For Increasing the Capacity of Coal-Gas Works, also for Incandescent Lighting, Driving of Gas-Engines, and Manufacturing Purposes.

(PATENTS IN ALL COUNTRIES)

THIS PROCESS HAS BEEN ADOPTED AT THE FOLLOWING GAS-WORKS:—

IN ENGLAND: WEST BROMWICH, ILFORD, TIPTON, CLEETHORPES, BILSTON.

ON THE CONTINENT: KÖNIGSBERG, ERFURT, ISERLOHN, REMSCHEID, PFORTZHEIM, PLAUEN, BARMEN-RITTERSHAUSEN, NUREMBERG, MÜLHEIM A/RUHR, LUDWIGSHAFEN a/R., GÜSTROW, BERNE, LYONS, GIJON, ROME, ARNHEIM, BRUMMEN,* OSTERFELD,* WARSTEIN,* WIBORG.*

[* Blue Water Gas with Incandescent Burners.]

ALSO FORTY INSTALLATIONS FOR MANUFACTURING PURPOSES.

## THE DELLWIK-FLEISCHER WATER-GAS SYNDICATE

25, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

# CONTENTS.


## EDITORIAL NOTES.

GAS, LIGHTING, &c.—

The British Association Meeting . . . 659
The Affairs of the Sheffield United Gaslight Company . . . . . 659
Trade Unions; the Gas Industry; and Free Trade . . . . . 660
The Need of Gas for Emergency Lamps . 660
Reading's Suitors—The Points for Consideration—Cost of Gas and Electricity—The "Cunning" Additions—From the Consumer's Point of View—A Leader Writer on Gas-Fires—Electric Arc Lighting—Ratepayers' Opinions—And Incandescent Gas—The Waverley Association Meeting—County Councils as Promoters—Example and Tactful Relations with Consumers—Revival of the Incandescent Mantle Combine Project . . . . . 661

## ESSAYS AND REVIEWS.

The Municipal Gas Consumer and the Cost of Public Lighting . . . . . 664
Blast-Furnace Gas-Engines . . . . . 665
Ammonia and Cyanides from the Air . . . 666
From Early Volumes of the "JOURNAL" . 666
The Fiddes-Aldridge Gas-Stoking Machine . 667
Gas and Water Stock Market . . . . . 668

## TECHNICAL RECORD.

Public Lighting Statistics—An Interesting Compilation by Mr. Canning. . . . . 668
The Manchester Gas Institution at Blackburn 669
Waverley Association of Gas Managers . . 673
Notes on Gas Purification. By Dr. H. Bunte 676
The Exeter Experiments with the Settle-Padfield Process . . . . . 677
Calcium Cyanamide: The New Nitrogenous Fertilizer and Source of Cyanides . . . 677
The Utilization of Atmospheric Nitrogen for Agricultural and Industrial Purposes . . 677

## TECHNICAL RECORD (*continued*)—

British Association of Water-Works Engineers—Mr. Henry Preston on the Geology and Underground Water Supply of South Lincolnshire . . . . . 678
Underground Water Supplies . . . . . 682

## REGISTER OF PATENTS.

Sulphate of Ammonia Saturators—Standfast, T. S. . . . . 683
Driving Gear for Retort Charging and Drawing Machines—West, J. . . . . 683
Strengthening Mantles Used in Incandescent Gas Lighting—Smith, H. S., and Mollart, C. H. . . . . 683
Purifying Coal Gas to Prevent Loss of Illuminants During the Operation — Holmes, W. C., and Co. (O. N. Guldlin) . . . . 684
Valve Apparatus for Combined Liquid Meters—Siemens Bros. and Co., Ltd. (The Siemens and Halske Aktien Gesellschaft) . 685
Toughening or Stiffening Incandescent Mantles—Thompson, W. P. (Eisenmann, R., and Bendix, J.). . . . . 685
Adjusting the Gas Supply to Incandescent and other Atmospheric Gas-Burners—Bray, G. & J. W. . . . . 685
Patent Notices . . . . . 685

## CORRESPONDENCE.

The Fiscal Question and Gas-Works Plant . 686

## LEGAL INTELLIGENCE.

Household Gas-Stove Company . . . . 686
Charge of Fraud against Mr. J. E. Addicks . 686
Stealing Gas at Dewsbury . . . . . 686

## MISCELLANEOUS NEWS.

Gas-Works Damaged by the Gale . . . . 686
Sheffield United Gaslight Company . . . 686
Provincial Gas Companies . . . . . 687
Harrow and Stanmore Gas Company . . . 688

## MISCELLANEOUS NEWS (*continued*)—

Attacking the Public Lighting Question at Reading . . . . . 689
Public Lighting of Newport . . . . . 690
Glasgow Corporation Gas Supply . . . . 690
Instructions as to Provisional Orders . . . 690
Opening of New Municipal Gas-Works at Southmolton . . . . . 691
Cost of Public Lighting at Rochdale . . . 691
Price of Gas at Middleton . . . . . 692
Parliamentary Committee on Municipal Trading . . . . . 692
Stock and Share List . . . . . 692
Progress of the Derwent Water Scheme . . 695
Notes from Scotland . . . . . 696
Current Sales of Gas Products . . . . . 698
Coal Trade Reports . . . . . 699

## PARAGRAPHS.

Preserving Coal by Submergence—Gas from Petroleum . . . . . 664
Engine Driving with Wood Gas . . . . . 665
Personal and Obituary . . . . . 666
North of England Gas Managers' Association 668
Monazite Sand . . . . . 676
A 40-Ton Oil-Tank Waggon . . . . . 678
Gas-Engines for Electric Driving . . . . . 681
Ferro-Concrete Water-Pipes—Wholesale and Retail Prices in 1902—The Chemistry of Colouring Matters . . . . . 682
Ballymena Gas-Works Purchase—Incandescent Gas Lighting at Swansea—New Joint-Stock Companies . . . . . 685
Fatal Fall from a Gasholder. . . . . 686
Reductions in Price—Colliery Managers and Gas Coal Contracts. . . . . 688
Metropolitan Water Board . . . . . 692
A Proposed Bridge for Water-Mains over the Trent . . . . . 698
Free Gas Stoves and Meters at Bollington—Disposal of Profits at Lancaster . . . . 699
Wilful Breaking of Lamp Glasses at Oldbury—Harrogate Water-Works Extensions . . 700



# Messrs. HUMPHREYS & GLASGOW

AND

THE UNITED GAS IMPROVEMENT CO., U.S.A.

# CARBURETTED WATER-GAS PLANT

— *DOUBLE SUPERHEATER SYSTEM.* —

H. & G., LONDON **136,700,000** Cu. Ft. Daily

U. G. I. CO., U.S.A. **373,500,000** Cu. Ft. Daily

**TOTAL 510,200,000** Cu. Ft. Daily

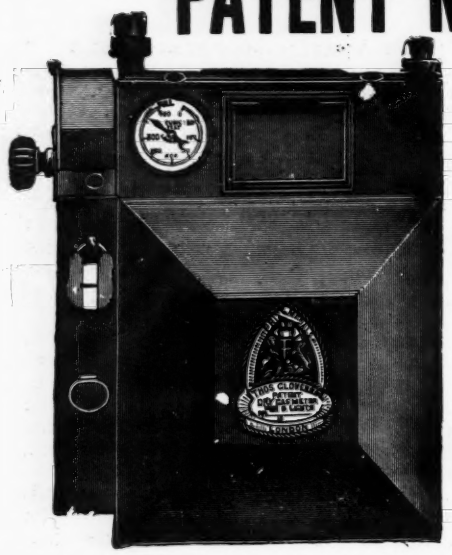
**Messrs. HUMPHREYS & GLASGOW,**
**38, Victoria Street, London, S.W.**
**31, Nassau Street, New York.**

**THE UNITED GAS IMPROVEMENT COMPANY,**
**Philadelphia.**

**Telegrams:** {"EPISTOLARY, LONDON." "HUMGLAS, NEW YORK."

# THOMAS GLOVER & CO.'S

# PATENT NEW IMPROVED PREPAYMENT METER



**For Pennies, Shillings, or any Coin.**

**Simple in Mechanism.**
**Positive in Results.**
**Price Changer *in Situ.***

**GUARANTEED FOR FIVE YEARS.**

**Telegraphic Address: "GOTHIC, LONDON."** **Telephone No. 6159 Bank.**

## THOMAS GLOVER & CO., LTD.,

**GAS-METER MANUFACTURERS,**

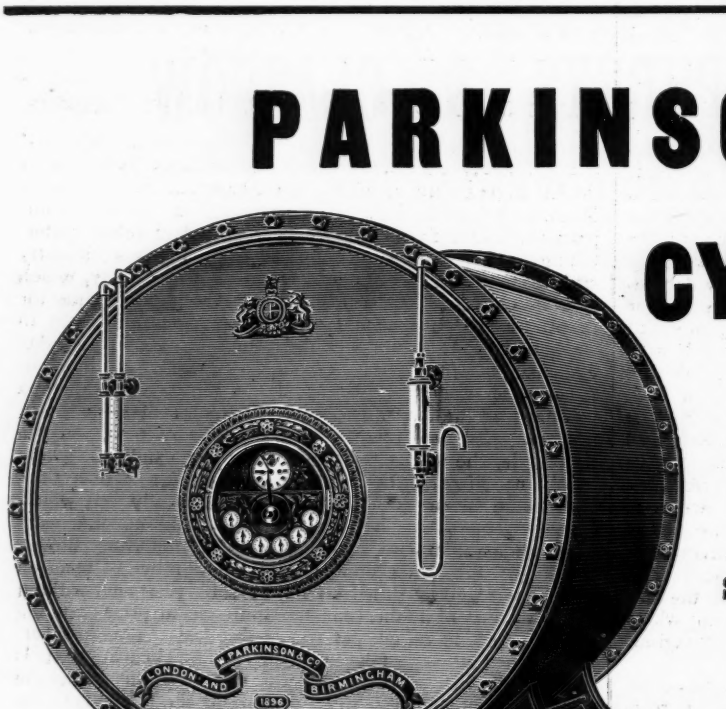
LATE OF CLERKENWELL, NOW 49, QUEEN VICTORIA STREET.

**Telegraphic Address: "GOTHIC, LONDON."** **Telephone No. 6159 Bank.**

| BRISTOL: | BIRMINGHAM: | MANCHESTER: | GLASGOW: | BELFAST: | MELBOURNE: |
|---|---|---|---|---|---|
| 28, BATH STREET. *Telegraphic Address: "GOTHIC,"* **Telephone No. 1005.** | 57 & 58, BROAD STREET. *Telegraphic Address: "GOTHIC."* | 132 & 134, CORN EXCHANGE BUILDINGS. *Telegraphic Address: "GOTHIC."* **Telephone No. 3898.** | 26, WEST NILE STREET. *Telegraphic Address: "GASMAIN."* **Telephone No. 6107 Royal.** | 8, EXCHANGE PLACE, DONEGALL STREET. *Telegraphic Address: "GOTHIC."* | 23, WRIGHT'S LANE, LONSDALE STREET. |

# PARKINSON'S

# CYLINDRICAL METERS




Some have been in constant use for over **60** Years.

PARKINSON AND W. & B. COWAN, LTD.
*(Parkinson Branch),*
COTTAGE LANE, CITY ROAD, LONDON.
BELL BARN ROAD, BIRMINGHAM.


[See also Advt. on last White Page.

# JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. LXXXIII., No. 2105.—TUESDAY, SEPTEMBER 15, 1903.


## EDITORIAL NOTES.

### The British Association Meeting.

THE British Association are meeting at Southport this year, under the presidency of Sir Norman Lockyer, whose inaugural address was of quite the "topical" order. Instead of following the example of some of the greatest Presidents of the Association in past years, and inviting his hearers to accompany him in a walk among the Eternal Verities in the pursuit of which his own life is passed, Sir Norman Lockyer elected to utilize the opportunity in the interest of higher national education. It was a bold thing to do; for if there is one subject of which the English people might reasonably plead to be spared further public discussion for a season, it is this terribly hackneyed topic of the University and the higher technical academy. Yet, voluminous as has been the controversial writing and speaking on the subject, it is by no means clear that the quintessence of wisdom, which is creditably supposed to be the ultimate result of the consultations of many counsellors on a matter, has hitherto been extracted. Sir Norman Lockyer did not mince his words of warning to his countrymen, but told them that what is wanted at the present juncture is eight brand-new Universities of the modern type, and £24,000,000 sterling to start them with. This demand is the feature of the address that will most impress the public mind. As to the request itself, it is possible to express the hope that Sir Norman Lockyer will get what he wants, while entertaining the belief that he is more likely to be disappointed.

For the truth is that the English people are not fond of systematized learning—a trait which, so far as it is racial, is of course incurable. But it can hardly be said that Universities and Academies have hitherto proved themselves of great value for those practical purposes to which advocates like the President of the British Association would now apply them. Our ancient Universities have been described as institutions for the cultivation of useless learning; and the description is so far accurate, that the proposal to spend large sums of money with a view to deriving some realizable advantage from establishments of the kind, appears to need more support from experience than has been forthcoming. Before taking Sir Norman Lockyer's advice, therefore, it would be only prudent to make sure that the prescription is in agreement with the results of experiment. Mind-power is what the nation chiefly needs; but whether this is more likely to be procurable through the multiplication of worthily endowed professors than by other means, is a very debateable question. Sir Norman Lockyer thinks the answer should be in the affirmative. But he is himself a professor; and "there's nothing like leather," to a shoemaker. It may be an odd view to take; but there are those who think that incalculable injury has been done to the reputation of Universities and Academies, as of the Army, by the kind of literature that purports to be descriptive of the inner life of these institutions. Tom Brown, Verdant Green, and Ouida's heroes, are of a piece in this respect, that they create the impression that the environments they implicate are of no serious import. Impressions of this character are apt to react in their own nature, and operate in the direction of perpetuating the hypothesis on which they repose. Thus we get an Army of professional soldiers in which the true professional spirit is wanting, and seats of learning where study is the last thing thought of by those who are imagined to be typical students.

It would be an injustice to Sir Norman Lockyer, however, to remember his British Association address merely from its demand for more Universities. It dealt with many pressing questions of the hour in a truly scientific spirit, not excluding the great fiscal problem. Upon this matter an observation of the President of the British Association may be cited here, inasmuch as it expresses a truth that has often been advanced in the "JOURNAL"—that the course of development of the world's industries does not wholly depend upon legislative enactments and systems of taxation. In the ordinary political and popular view of this matter, as Sir Norman Lockyer remarked, "the whole course of the modern "world is attributed to the presence or absence of taxes on "certain commodities in certain countries. The fact that "the great fall in the price of food-stuffs in England did not "come till some thirty or forty years after the removal of "the Corn Duty, between 1847 and 1849, gives them no "pause; for them new inventions, railways, and steamships "are negligible quantities; the vast increase in the world's "wealth in free trade and protected countries alike comes "merely according to them in response to some political "shibboleth." This is precisely our own doctrine, as expounded here these many years past.

The sectional addresses of the year's meeting appear to be of at least the usual degree of excellence. The President of the section devoted to Mathematics and Physics is Professor Vernon Boys, one of the London Gas Referees, who found many things to talk about in the clear and engaging style which distinguishes the man—and which, let us remark, mere schooling cannot impart. His first subject was radium, the wonderful form of matter that throws into the shade all the ancient dreams of the Philosopher's Stone. For radium is an accomplished fact; and, like most other facts that Nature reveals from time to time, it has confounded the speculations of orthodox science, as it has transcended the imagination of romancers. Just as no writer of tales of wonder anticipated the discovery of Röntgen, so nobody prophesied of radium. "An atom of radium can constantly "produce an emanation that is something like a gas, which "escapes and carries with it wonderful properties; but the "atom, the thing which cannot be divided, remains and "retains its weight. The emanation is truly wonderful. It "is self-luminous, it is condensed by extreme cold and "vaporizes again; it can be watched as it oozes through "stop-cocks or hurries through tubes; but in amount it is "so small that it has not yet been weighed." All that Professor Boys had to say besides of this amazing material is of absorbing interest. He also made many wise observations on the everlasting topic of education.

### Affairs of the Sheffield United Gaslight Company.

THE proceedings at the general meetings of the Sheffield Gas Company are always interesting—mainly by reason of the intelligent way in which the Chairman, Sir Frederick Mappin, brings to bear upon the concerns of the Company the accumulated experience reported of other undertakings. The case of the Sheffield Company is sufficiently striking to call for comment. Here is a Company, which is as much as to say that according to the popular craze for the municipal equivalent for Socialism, Sheffield ought to show a shocking example of dear and bad gas, and popular dissatisfaction with the service. But the truth happens to be quite otherwise. Sheffield gas is made to satisfy a standard of illuminating power of 16½ candles, tested in the city; and in order to be quite sure of being on the right side, the works tests average 17·39 candles. There can be no mistake about this, as the average is over 1119 tests made during the half year—a notable tally. It would be more convincing if some other undertaking one hears of in connection with this matter of illuminating power, would similarly place upon record the number of tests on which the results claimed are supported. Sheffield, without the possibility of doubt, sells 17-candle gas at prices ranging from 1s. 10d. to 1s. 6d. per 1000 cubic feet. This is a performance that will take a good deal of beating. It is coincident with a reduced total consumption; but the Chairman knows better than to mention the coincidence as an illustration of the indifference of the public to the price of gas. As a matter of fact, although the gross sale of gas in Sheffield has been less, gas itself is growing in popular favour for all purposes, as the statistics of public lamps, meters, stoves, and gas-engines amply prove. The truth is that Sheffield, like most other gas companies, is feeling the effect of the sudden leap into public favour of the incandescent gas-burner, which, broadly speaking,

consumes somewhere about 20 per cent. less gas than the flat-flame burners which it is so rapidly superseding. Sir W. T. Makins was justified in laying stress upon the value of incandescent gas lighting to the cottager. We have never been able to understand why the slot-meter class of consumers should be officially supposed to be less able than others to appreciate and make proper use of incandescent burners. On the contrary, in small houses where a good deal of dressmaking and other fine work goes on, the advantage of a brilliant light is most likely to be valued. Nor does it seem a sensible idea to deny the cottager a brightness at home which the public-house is not remiss in offering. Sir F. T. Mappin is strong on the benefits of incandescent gas lighting for street-lamps, railway stations, and large works; and it may be taken for granted that the officers of the Sheffield Gas Company are kept up to the mark of efficiency in looking up these classes of business. There is a heavy trade done in power gas, too, in Sheffield—a branch of the business which ought to prove susceptible of much expansion. Altogether, the interest of the Sheffield Company's prosperity is not merely limited to the fact itself—for prosperity is a common experience of gas undertakings in the United Kingdom—but proceeds from the manner as well as from the matter of it.

## Trade Unions; the Gas Industry; and Free Trade.

THIS year's meeting of the Trade Union Congress, held at Leicester, should have been of exceptional interest, if it were possible to take at all seriously the formal proceedings of this annual assembly of "organized" workpeople. For a good deal has happened of late, both in national politics and in regard to legal matters, upon which the considered opinions of truly representative working men should be worth having. There is the great fiscal question, for one thing; for another, the effects of recent judgments of the Courts upon the office of trade combinations in the commonwealth. Intelligent working men, in common with all other classes of members of the body politic, must be greatly concerned with the question of how this Empire is to be financed in the future; and one would like to hear at first hand how the matter strikes them, so far as they have yet been able to grasp the issues presented to the country. Unfortunately, experience has shown that practical grip of the essentials of political problems is about the last thing to be looked for in the so-called deliberations of a Trade Union Congress. Everything is dealt with by Trade Union delegates in a cut-and-dried fashion, which can only be fairly characterized as consistently disappointing. The strength of the language employed by these delegates of trade societies is usually in inverse proportion to the force of their recorded resolutions. It was so again at the Leicester meeting, where it was almost unanimously agreed to "strongly condemn" the suggested revision of the national fiscal arrangements, and to "make "every effort" to resist a change of system, of whatever nature. Of course, this additional example of giving a verdict without hearing the evidence was to have been expected. All the forces of prejudice may as well advertise themselves in this way, while there is time. They will not avail to arrest inquiry, nor to prevent thoughtful men from endeavouring to form their own judgment according to the evidence. It may gratify Mr. Pete Curran, of the Gas Workers' Union, to feel that Mr. Chamberlain has to reckon with him; but there is no apparent reason why those who are not prepared to side off-hand with Mr. Chamberlain should place implicit faith in Mr. Curran.

It never occurred to a single speaker on the subject at the Congress that Trade Unionism and Free Trade are mutually contradictory. Men have died at Leicester because they dared to think they might dispose of their labour according to their own will and pleasure, and not in obedience to the dictates of a society executive. There were ghosts at the Congress, but no "mediums" to convey and publish their views of the proceedings. How can a Trade Unionist be truly a Free Trader? It is impossible. One might regret that nobody ventured to tell the Congress what the late Mr. Cobden would have thought of their ideals. Trade Unions are among the things that have happened since 1848, as Mr. Chamberlain will probably find an opportunity for reminding his opponents in due course. Trade societies are protective to the last degree; and whether an industry is protected by society rules, or by an import duty, is rather a distinction than a difference. In both cases the real object is the same—to prevent the article protected from being sold as cheaply as it would otherwise be possible to market it. If Cobdenism means that the rule of cheapness to the consumer should prevail, then modern Trade Unionism is utterly opposed to it. That it is so opposed in the interest of one party to production does not alter the character of the attitude assumed. Trade Unionism in a thoroughly Protectionist nation, as the United States, is at least consistent with the national industrial system. The financier, like Mr. Carnegie, has his tariff; and the workman can have his Union, to see that he gets his full share of the benefit of the system. That is logical. For a Trade Union Congress of the United Kingdom, breathing the air of Leicester, of all manufacturing towns, to profess a regard for Free Trade principles, argues a total lack of the sense of humour in the assemblage.

It is partly for this reason that in "JOURNAL" references to the fiscal question, so much stress has been laid upon the desirability of first-hand knowledge of trade conditions being relied upon as material for the formation of individual opinions on the fiscal question. The British gas industry is a protected industry, no less. There is no Free Trade in gas in this country; and for gas engineers and directors to profess themselves Free Traders, without remembering this circumstance, would be to incur the gibes of the critical. We are all liable to take words for facts, and to profess belief in one thing while practising another. It is a cause for thankfulness that in this fiscal question there is none of the *odium theologicum* that has poisoned so many discussions of the subject of education. There is no point of conscience involved in it, seeing that reverence for the deceased Mr. Cobden has not become a tenet of any sect; but prejudice is almost as strong as faith. The difficulty is to preserve an open mind. Some so fear the consequences of asking questions concerning fiscal matters, that they solemnly warn people against inquiring into the first principles of taxation or their application by different nations. This timidity on the part of a people who live under such singular ordinances as the poor law of Elizabeth and the income-tax, is a strange and not very prepossessing phenomenon. Let us have the matter all out, whatever there may be in it; so that any decision that may be arrived at shall at any rate be made open-eyed.

## The Need of Gas for Emergency Lamps.

AFTER what was recently suggested by the "JOURNAL," with regard to the emergency lighting of such places as the tunnels of underground railways, it is a striking coincidence that a breakdown on the Central London Railway should have so quickly followed after the disaster on the Paris Metropolitan. Only, the consequences were different. There was an interruption of the traffic; and the passengers in the stopped train merely stepped down and walked out to the nearest station. This incident may serve as an illustration of the difference between the British and the French temperaments, which goes to explain so many things that do not enter into the educationist's philosophy; but it does not at all discredit the call for some absolutely independent method of lighting places which are, or may at any moment become, crowded with frightened people wildly escaping from the scene of a fire. It is hardly realized sufficiently by people with no experience of the kind, that darkness is one of the chief sources of danger and horror at a great fire. One is naturally prone to think of the blaze and light of the leaping flames of a burning building; but that is the outside view of what is happening. Indeed, it may be remarked that whosoever is in a situation to witness the light proceeding from a conflagration is in a safe place, provided he is not too near the heat for his personal comfort. Fatalities from fires in enclosed places occur at the very beginning of the affair, while there is more smoke than flame. Then it is that the horror of sudden darkness is to be dreaded. The first order of the London Fire Brigade to the attendants on the spot, in connection with an alarm of fire in a theatre, is to "turn up all the lights everywhere," so that people can see their way about. How far it is safe and prudent to rely for emergency lighting, and even for public street lighting, upon a method of distributing the illuminant which must fail everywhere the instant a wire is broken, is a question to be answered after due deliberation by those who are ultimately responsible for the public safety. It is easy and cheap to say that, of course, gas engineers will favour gas lighting; but the point at issue between gas

and electricity for emergency lighting is very clear and very definite. Gas by itself can neither cause nor spread a fire. There must be a means of ignition if it is to burn at all; but when once set alight, as in an emergency lamp fixed inside a tunnel, nothing that is likely to happen while a living person remains in the place will put it out. A strong electric current, as everybody knows, can both originate and spread fire without external aid; and any light supplied by this means is only too easily extinguished. It is for this reason that the advocacy of gas-lamps for the emergency and safety lighting of railway tunnels, even where the traction is electric, must possess force and cogency that cannot be met by sneers at interested motives, nor satisfied with assurances that extra electric lamps provided for the occasion will answer every purpose. Some purposes, doubtless, can be served by this expedient, which is provided by the Central London Railway Company, whose tunnels are fitted with electric lamps in view of just such interruptions of traffic as the accident under notice. This, however, is not the same as provision against fire which would destroy the insulation of all lighting wires, and break all lamps, just when their aid would be most needed to save life.

## Reading's Suitors.

If the Reading Corporation go astray over the question of the future lighting of the borough, the fault will not rest upon the Gas Company. With commendable promptitude, they have complied with the request of the Council, and supplied them with schemes, estimates, and a report of considerable value on the general question. Of course, the councillors will know better than to suppose that the report exhausts the subject. That is more than could be expected in a document of the kind; but it places before the councillors the grounds on which the Company submit that preference should be given to incandescent gas lighting rather than electric lighting, with such carefulness and clearness that even the superficial reader cannot fail to absorb their importance. The schemes, estimates, and report complete are the work of the Company's Engineer (Mr. D. H. Helps). It was a big job for him to have to enter upon so soon after taking up his new command, and before the strangeness of his fresh surroundings could hardly have worn off. But it happens to be a contest to his liking; and, as the report shows, he has entered upon it with considerable zeal and tact. The interest with which the report has been read by us will, we are sure, be shared by readers, many of whom may find very useful the extracts published elsewhere. We cannot, at the moment, examine the report with any great profit, for the simple reason that the schemes and estimates of the Electric Lighting Company are not available for comparison. Both Companies, however, have done wisely in submitting their respective reports individually to the members of the Council, as this will give them adequate time to consider the entire position previous to the discussion of the recommendations of the Committee who have the matter in hand.

## The Points for Consideration.

What the councillors have to consider is this: By what system—incandescent gas burners or electricity—can the borough be efficiently lighted at the smallest increase of cost to the ratepayers? And what they have to justify is any recommendation that the ratepayers should be asked to contribute more than an extra sum of £646 per annum for the improved lighting of their streets, seeing that, for this increase, the Gas Company are offering them an addition to the illumination of the streets of upwards of 100,000-candle power. In other words, to replace the antiquated system of lighting which has nightly shed a total illumination of only 22,965-candle power over the streets of the town at a price of £4187 per annum, the Gas Company now offer a system, which for a further £646 a year, will flood the streets with a genial, well-diffused light of 138,670 candles. Now the question is, Can the electricians do the same thing for such a small additional cost? If they cannot, then the duty of the Council to the ratepayers is clear. The ratepayers surely do not want to pay more for their public lighting than is necessary. They do not live out in the streets of Reading at night time in the winter months; and so all they need are streets efficiently and economically illuminated for pleasant and safe locomotion. Why should the rates be increased one halfpenny more than is needed just to satisfy the fads of a few? For that is what it amounts to. Several members of the Town Council of Reading have already shown their prejudice and extravagant and mistaken notions over this matter; and therefore those particular members cannot be the best persons to pronounce judgment upon the reports which are now before them. It would, under the circumstances, be a good thing for Reading if the final decision was left to the ratepayers, after the reports have been duly considered. We repeat the salient question, Can a greater increase than £646 on the present public lighting expenditure of Reading be justified? We await the answer.

## Cost of Gas and Electricity.

There is an amusing attempt in the "Electrical Review" this week to deal with the attacks which are being made on the "unabashed persistence" (those are the words our contemporary applies to the resistance of gas suppliers) of electricians to defame gas by ignoring the existence of the incandescent gas-light; and the attempt is not only amusing but a signal failure. The "Review" was goaded into action by a circular emanating from Tottenham, in which the costs of the two methods of lighting were compared; but as the writer proceeds to show on another basis how erroneous (?) are the statements made, we need not quote the figures here. Though, in his opinion, "it is, no doubt, somewhat superfluous to point out the fallacies and the cunning omissions with which these statements are compiled, . . . . for the sake of those among us who ask why, in the face of these allegations, electric lighting thrives apace" [Cheltenham, Islington, and certain other places ought not perhaps to be cited as examples], he "looks into them for a moment." In doing so, the writer makes some very "cunning" (if he will forgive the use of his own elegant term) additions; but, even by their aid, he cannot get the cost of lighting a house with gas up to more than 4·3d. per day, as compared with 5·94d. for electric lighting. Now let us see how this immaculate defender of electricity achieves this result. He takes a dwelling-house containing eight rooms, fitted as follows: Dining-room, three 16-candle power electric lamps, or one 3¼ cubic feet incandescent gas-burner; drawing-room, do.; kitchen, one 16-candle power electric lamp, or one 1½ cubic feet incandescent gas-burner; scullery, one 8-candle power electric lamp, or one 1½ cubic feet incandescent gas-burner; four bedrooms, each one 8-candle power electric lamp, or one 1½ cubic feet incandescent gas-burner; two passages, each one 8-candle power electric lamp, or one 1½ cubic feet incandescent gas-burner. He does not stop to explain why the rooms will require a smaller quantity of light by electricity than would be given by the gas-burners. However, to him that is apparently a small matter; or it may be a "cunning omission." Then he supposes that the lights would be used, averaging all the year round, as follows Drawing room and dining room, one or other four hours per day, kitchen four hours per day, scullery two hours per day, bedrooms (say) half-an-hour per day, and passages four hours per day.

## The "Cunning" Additions.

Having premised thus, the writer calculates the 16-candle electric lamps to consume 60 watts each, and the 8-candle ones 33⅓ watts; and here is where the fun begins—he does not forget (it was very necessary in his difficulty that he should not do so) the bye-passes of the gas-lamps! Did ever anyone witness such absurd argument in a technical paper? Claiming a fairly intimate knowledge of what gas consumers buy in the way of incandescent burners, we beg the writer in our contemporary to take it that the bye-pass is the exception rather than the rule; so that, even assuming that the figures given in the "Review" for bye-passes are correct (it is not admitted they are), they would not apply in the majority of cases. However, the bye-passes that the writer has in mind must be unrestrained gluttons; for in that eight-roomed house they are credited with consuming 55 cubic feet of gas per day, as against the 37 cubic feet used in the actual lighting. What waste! By this means, this ingenious electrical controversialist contrives to make the total gas consumption 92 cubic feet per day, as compared with 1360 watt-hours for the electric lighting. Therefore, he finds that the cost of energy per day, at 4d. per unit, would be 5·44d., as against 3·3d. for gas at 3s. per 1000 cubic feet. Now 3s. is not what is called in the gas industry a low price for

gas. But we need not quarrel over that; the price answers our purpose, or a much larger one if he likes, in any comparison of incandescent gas lighting with the electric light. But inasmuch as the bye-pass is the exception rather than the rule, we will do the right thing, and cut off that generous consumption of 55 cubic feet, which leaves us with 37 cubic feet of gas to come into charge for actual lighting, and this brings the cost down to (say) 1·55d. Well then this perverter of the truth puts the cost of renewals per day at 0·5d. for the electric lamps, and 1d. for the incandescent gas-lamps! This is another "cunning" addition for the purpose of getting the price of gas lighting as near electricity as possible. Experience with far larger installations than the one named places the actual cost of renewals at a small fraction of 1d. per day; but we will allow the writer ½d. as the cost of renewals in the illustration. This brings us, taking the "Review's" modest prescription for the lighting of an eight-roomed house, to a total outside cost of 2¼d. per day with incandescent gas-burners, as against (assuming the correctness of the figures) 5·94d. for electricity.

## From the Consumer's Point of View.

If our electrical contemporaries cannot make comparisons without going to such senseless extremes as these, then they had better give up the contest, for they only bring ridicule upon themselves. We are not without experience as to the cost of lighting a house by both systems; and, with a comparable illumination, the ratio of cost is found to be nearer the Tottenham statement of 6 to 1 than the "Review's" figures of 1·4 to 1, with prices obtaining in another suburb of London. To ordinary consumers, the total amounts of their lighting accounts, for the illumination they require, speak louder than such (to them) unintelligible words as watts, watt-hours, units, and volts. Speaking of consumers, reminds us that we ought not to deny our readers a final laugh over the concluding words of our contemporary's puerile attempt to make out a good case for electric lighting. They are: "These periodical outbursts on the part of the gas people do them no credit; but fortunately they do little harm to the electricity suppliers, as consumers have been 'so long' accustomed 'in the past' [there is a little superfluity here] to gas-meters and their audacious declarations, that they attach little importance to the allegations of the gas makers." And this in a technical paper! We wonder whether the writer could produce a hundred or any other number of electricity meters that would show a smaller percentage of error, if referred to the Standards Department of the Board of Trade, than a similar number of gas-meters taken indiscriminately from any district. It is exceedingly kind of our electrical friends to occasionally treat us to such delectable matter as this for week-end reading.

## A Leader Writer on Gas-Fires.

The "Engineer" has a leading article on the subject of domestic gas-fires; and the writer has either had a very bad experience, through indiscretion and carelessness, with these ordinarily useful and comfort-promoting adjuncts to the household, or he has not written from personal knowledge. He does not mince matters. "The gas-stove," he defiantly asserts, "is not a satisfactory apparatus for heating houses; and it is not cheaper than coal fires." If the gas-fire is lighted at seven in the morning, and is kept going until an hour or so before midnight, it may at once be agreed that it is not—at most present gas prices. If it is only used when wanted, and is not allowed to burn wastefully, then it is cheaper than the coal fire, which must be maintained the day through, unless the trouble, labour, and expense of rekindling are not objected to every time it is required. All the little faults that the writer could find about the gas-fire are magnified to the fullest extent; the polluting, dust and labour creating, and attention-demanding characteristics of the coal fire are ignored, and are not placed in the balance against the misdemeanours of the gas-fire. One of these is that the gas-fire renders the air of a room unpleasant; but why, the writer cannot explain. If he has a gas-fire properly constructed and fitted, then there must be something wrong with his ventilation or chimney draught if there is such disagreeableness as that of which he speaks. Complaint is also made of the noise of a gas-fire; and this is a serious source of aggravation to him. The hissing noise has been very much reduced in the newer forms of fires; and the user, if sensitive, can easily relieve himself of any small annoyance by diminishing (as he should do) the gas supply to the fire after the room has become thoroughly warmed. Then another objection is the lighting-back of the burners. The writer says they "*will* light back," just as though human ingenuity is unequal to the bringing of the "will" of a gas-burner into subjection. Our best gas-fire makers would be very pleased to supply the "Engineer" with stoves that will not light-back unless extraordinary means are resorted to for making them do so. But after all his harshness, the writer recognizes the weak spot from which arises all the complaints. He says: "That the gas-stove is not better than it is, is partially the fault of the consumer. When he goes a-buying a gas-stove, he turns Dutchman, and nothing will content him but to have a great deal for a very little money. The manufacturer spends the money where it will show; and he makes the burner as cheap, and therefore as crude, as possible. Now a little more money on the burner, and, at any rate, striking-back when lighting might be prevented, and possibly something might be done to get over the noise." We finished the perusal of the article wondering whether our friend of the "Engineer" is one of those consumers who when, at some time or other, he has gone a-buying a gas-stove has turned Dutchman, and nothing would content him but to have a great deal for a little money. If so, we are not surprised at the bad experience traced in the forepart of his article.

## Electric Arc Lighting,

When noticing in last week's "JOURNAL" an article on the subject of municipal trading which had appeared in the pages of an esteemed contemporary, we expressed entire agreement with a statement made by the writer that "it would be well if this problem were always approached with a due sense of the obligations of the community to those who perform municipal work." Being in such complete accord with this view, it is our intention now to point out as clearly as possible the nature of the "obligations" of the ratepayers of Newport (Mon.) to those members of the Council who last week succeeded in getting a scheme carried for the extension of electric arc lighting in the town. It is not by any means a new story; on the contrary, it is just as old as the municipal electric lighting craze itself. We refer, of course, to the installation by local authorities, at a cost entirely disproportionate to the resultant illuminating effect, of extensive systems of public electric lighting. In the great majority of instances, this is done chiefly with the object of benefiting the electricity department, which is far too often in dire need of some such artificial support; and the figures quoted in another part of to-day's issue lead one to suspect that this must have been the case at Newport. At any rate, we are altogether unable to find any other probable explanation of the decision arrived at there. The difference in first outlay and annual cost of the two systems is enormous; and for all the extra money they are to spend, the Corporation will certainly get less light than they would have obtained had they adopted the proposed triple self-intensifying Welsbach incandescent gas-lamps. At the Council meeting one member did venture to ask why the offer of the Gas Company had been refused; but he received very little satisfaction. "Was it likely," asked the Chairman of the Electricity Committee, "that, after giving the town the illumination they now had from electricity, the Committee could recommend a return to gas?" Well, such a thing has been known to happen—in more enlightened places than Newport. Then, again, the talk about going back to the "Dark Ages" was hardly worthy of introduction at a business meeting, especially when one bears in mind the fact (which Alderman Moses might have learned for himself, if he had made inquiry) that intensified incandescent gas lighting is quite a modern invention.

## Ratepayers' Opinions,

However, in view of the additional money which will now have to be found for the new arc lamps, Alderman Moses and the other electric lighting partisans in the Council must not complain if the ratepayers fail to appreciate their obligations to them for the way in which they perform the public work of the town, and come to the conclusion that the bolstering up of a municipal electricity undertaking by means of an extravagant system of public arc lighting is a very mistaken policy. Indeed, it would seem that

the citizens are already beginning to feel seriously alarmed at the way in which the undertaking is being carried on by their representatives; for the Ratepayers' Association have written to the Local Government Board expressing the opinion that an exhaustive inquiry into the state of the borough finances should be made before any more loans are sanctioned, and asking for details regarding a sum of £58,700 which the Corporation are anxious to borrow for electric lighting purposes. The rates are rising, and are likely to still further rise; while of the money now proposed to be raised, a portion has already been spent, and it is understood that there is an enormous overdraft at the bank. The Association consider that the cause of all the trouble is the sudden development of municipal trading, as to the effects of which the great body of the ratepayers are being deluded by estimates which would show heavy losses on the rates if corrected in certain particulars. These they state to be assessment to the poor-rate, a fund provided for upkeep (where at present there is none), a fair proportion charged for legal and general expenses, and the right amount entered for transfers from one department to another. Whatever may be the state of affairs at Newport, it is certain that in very many cases the proper adjustment of these items would make a vast difference in the aspect of affairs. The Local Government Board, however, state that the questions of assessment and a fund for upkeep do not come within their jurisdiction, but that any evidence as to the existence of an overdraft at the bank may be brought forward at the inquiry which will be held into the Corporation's application for the loan. They also say they will be prepared to furnish the Ratepayers' Association with an estimate of the cost of the works for which the money is required, when received from the Council, "if the Association satisfy the Board that they do, in fact, represent to any material extent the ratepayers of the borough." From all this, it is clear that at Newport municipal trading is not regarded as an unmixed blessing; and the local inquiry will in all probability be a very lively affair. Meantime, the present rate of 7s. 11d. in the pound (with a prospective substantial increase in the future) will keep the citizens amply reminded of the debt they owe to their representatives on the Council.

## And Incandescent Gas.

If Alderman Moses is really in doubt as to the value of incandescent gas lighting, he will derive a lot of useful information from a careful study of a table of public lighting statistics prepared by Mr. Thomas Canning, the Engineer and Manager of the Newport Gas Company, which appears in our "Technical Record" to-day. He will learn, for instance, that incandescent gas lighting for streets is very largely on the increase at the present time—even in towns in which the electricity works are in the hands of the local authority, while gas has to be purchased from a company. The places to which the statistics relate are not what could be called unimportant ones, and certainly they are not those which would be suspected of possessing the least desire "to go back to the Dark Ages." There should be quite sufficient food for reflection in this table; but if after perusal of Mr. Canning's figures the Chairman of the Newport Electricity Committee should still feel that he would like further evidence of the superiority of incandescent gas over other systems of illumination for public purposes, he might do much worse than turn his attention to the speech made by Sir Frederick Mappin at the recent meeting of the Sheffield United Gaslight Company. That city is lighted practically entirely by means of gas-lamps; and the result is perfectly satisfactory. Then, again, there is the well known case of Liverpool, where the Corporation are increasing the incandescent gas lighting, which is in the hands of a Company, rather than extend the use of their own current for the public lamps. If, however—and we have already stated that this is our opinion—Alderman Moses and his Committee have been actuated by a desire to assist their electricity undertaking, rather than by belief in the superiority of arc over incandescent gas-lamps, it is useless to ask them to give full consideration to the relative advantages of the two illuminants.

## The Waverley Association Meeting.

There is so much similarity between one meeting of the Waverley Association of Gas Managers and another, that what is written about the one might almost be repeated about any other. They are always so free from restraint that a happy feeling pervades them, while the views which are expressed are the untrammelled and unreserved messages from mind to mind. Frequently the subjects dealt with are of little concern except to the members themselves; but on this occasion a note of much wider interest was struck by the President (Mr. P. Blair, of Haddington) in his address. If the results of his calorific tests do not coincide with generally accepted ideas, it is not the first time that conclusions which were supposed to have been well grounded have been upset by actual experiment; and if anyone questions them, it is open to him to proceed upon the same lines, and satisfy himself as to where the truth lies. The well in this instance is not so deep but that it can be sounded by anyone who likes to go to the trouble. It may be taken for granted that, as Mr. Main—himself a manufacturer of gas-stoves—indicates, there will be such searching as there has not been before into cause and effect in this matter. This was probably not the intention of Mr. Blair when he entered upon his experiments; but it will be surprising if his action does not lead to more extended and closer observation. If this should be the effect of it, the use of gas for heating purposes will be placed on a more certain basis, and he will have the credit of having initiated the step forward. The remarks of Mr. M'Lusky shadow forth a much more extended inquiry than Mr. Blair attempted, or was able to attempt, in the heating power of the gases produced by various known processes. Undoubtedly it would be of advantage to a gas manager who might be supplying water gas, or gas enriched by benzol, to know exactly what heating effect it might have at the illuminating power he works up to, because he could then set about selecting the apparatus most suitable for its combustion, or adapting the burners or whatever apparatus he might prefer, so as to get the fullest heating effect. Surely this is not too visionary a prospect; and if it should be realized, even in part, who will be able to measure the amount of good to the gas industry the beginnings of which it may be possible to trace from the little gathering of the Waverley Association at Haddington?

## County Councils as Promoters.

It may be expected that we shall frequently see County Councils in Parliament in future sessions as promoters of Bills as well as opponents, seeing that an Act comes into force on the 1st prox. which will enable them to do so. They are not likely to overlook this extension of their powers—at all events, the Local Government Board are minded not to let them do so, as they issued a circular last week directing their attention to the matter If County Councils throughout the country make the same use of the new power as the London County Council have of their privilege, there may be some lively times of the County Councils' own creation in the Parliamentary Committee rooms. The Councils are directed as to the costs of promoting or opposing a Bill. Though these no doubt would be properly chargeable upon the whole area of the county, cases may sometimes arise where expenses may be incurred by a Council in relation to the promotion or opposition to a Bill which affects only a portion of the area under their jurisdiction. The new Act empowers the Council to determine that the expenses in such cases shall be regarded as incurred for special county purposes; so that they will be charged upon the parishes comprised in that portion of the county which is specially affected, instead of over the entire area.

## Example and Tactful Relations with Consumers.

As was shown last week, gas managers in America recently had before them a paper by one of themselves on that important administrative question—conduct in conciliating, and gaining and maintaining the friendship of, consumers. Within a short time of the reading of that paper, the National Electric Light Association, meeting in Chicago, had before them a contribution of the same order—the title being "Tactful Relations with Consumers." It is a thoughtful dissertation, and is as applicable to any other line of business as to electricity supply. The author was Mr. John W. Ferguson; and he had a few words to say to the responsible heads of business concerns as to the importance of their deportment as an example to those under them who have to come into more immediate contact with the customers. It is true, but it is often lost sight of, that the methods of employees will in most cases be found in line with the methods of the head

and for this reason *suaviter in modo, fortiter in re* should be the governing principle for all heads of departments. By precept and example, they should so impress upon their assistants their duties to the concern and the public that tactful relations with the customers may be maintained without jeopardizing the best interests of the undertaking. Upon each and everyone—from office boy to chairman—depends the reputation of the concern and its popularity (or the lack of it) with the public. More especially does the duty of maintaining friendly relations with customers devolve upon the inspector, collector, meter-reader, and the repair men; and tact, courtesy, and good faith on their part are indispensable qualities. Subordinate officials who cultivate these are paving the path to promotion. It should not be forgotten by them that the responsible manager must, if he keeps an eye on the outdoor business, soon learn the districts from which most complaints are received, and the districts in which most friendly or antagonistic customers are to be found; and these serve him as an index to the tactful methods or otherwise of the outdoor officials. Of course, in every supply area some crotchety customers are to be found; but it would be a queer condition of things if they were all congregated together in one small district. These are a few of the impressions which points in Mr. Ferguson's interesting paper leave upon the mind.

### Revival of the Incandescent Mantle Combine Project.

The "Manchester Courier" is responsible for this paragraph: "Welsbach shareholders will hear with some interest that negotiations are proceeding in Berlin for the formation of an international combine of incandescent mantle manufacturers. It is alleged that at present the mantles are selling at a price which hardly covers the cost of manufacture, and that something must be done if the trade is not to meet with disaster. Some of the large German concerns have hitherto maintained an unfriendly attitude towards the proposals; but doubtless they will fall into line if the negotiations make any favourable progress. The trade has suffered enough, goodness knows." We cannot subscribe to our contemporary's remark "that at present mantles are selling at a price which hardly covers the cost of manufacture." If there are signs of "disaster" ahead, it must be looked for elsewhere than in the price of mantles. During the summer months, the demand for them on the wholesale houses has exceeded that of any previous year; and the stocks they are now holding are not, we believe, so extensive as those which they have hitherto possessed at this period—before the commencement of the lighting season. The trade may have suffered, but it has not been of late. On the contrary, they have been doing remarkably well. If they have any anxiety at all, it is in the direction of the temporary cloud that is hanging over the thorium supply, pending the settlement of the monazite sand contract.

**Preserving Coal by Submergence.**—With reference to the deterioration of coal stored in the open air, Mr. J. Macaulay, General Manager of the Alexandra Docks and Railway, at Newport, has recently made experimental tests with fuel submerged for various periods, the results of which are striking. Some of the coal had been dredged from the mouth of the Usk, where it is believed to have lain for ten years and upwards; other samples had rested for as long a space at the bottom of the Alexandra Docks; while a third sort had been under water about three years. When tried upon locomotives, the best effect was produced by the coal longest submerged; while that which had been three years under water came only slightly behind good fresh-hewn fuel. Mr. Macaulay draws the conclusion that coal would be best preserved by storage in large subaqueous concrete reservoirs.

**Gas from Petroleum.**—We learn from the "Ironmonger" that a process for manufacturing gas from petroleum has been patented by Mr. R. Reid, of South Yarra, Melbourne. In its manufacture only a small apparatus is used, consisting of a receptacle for holding petroleum, with a pipe leading into what appears to be a mere iron box placed on a common spirit-stove. There the fluid is heated, and transmitted in the form of gas along another pipe through a tin of water, where it is purified. The gas then passes into a gasholder, whence it is conducted by means of pipes to any spot desired. An exhibition was given a short time ago at Hamilton; the experiment being made with an incandescent burner. One jet in the room was lighted with the new gas, while the corresponding jet was served with ordinary coal gas. Using the Welsbach burner and mantle, it is claimed that a light of 75 candles can be obtained at a cost of 1d. for twelve hours' burning. With the petroleum gas, only one hole is pierced in the burner; the air-holes being correspondingly increased, owing to the gas being so rich in carbon. It is stated that the new gas can also be used for cooking and heating.

# ESSAYS AND REVIEWS.

## THE MUNICIPAL GAS CONSUMER AND THE COST OF PUBLIC LIGHTING.

NEVER have we been able to find any valid reason for the ridiculous position occupied by those municipalities who, owning the gas undertaking, throw upon the gas consumers the whole burden of expense of public lighting, which is a service carried on—just as much (say) as the sewerage system or police—for the benefit of the entire community. The position, indeed, is an altogether untenable one, and the more those argue who try to defend it, the deeper into the mire do they get, and from out of their own mouths is the injustice frequently established. The matter has just been discussed again at Rochdale; and the Council have at length, and very properly, come to the conclusion that the right thing to do is to revert to the *status quo ante*, and to make the public lighting a charge upon the whole of the ratepayers. The matter has at intervals occupied the attention of the Gas and Electricity Committee for the past five years, so there must have been several members who, over that period, have had some difficulty in resigning themselves to a continuance of this imposition on the gas consumers. But now an eminent firm of accountants have been overhauling the accounts of the borough; and though it must be admitted that they found little to criticize, they did make a few recommendations having for their object the bringing of the accounts to as near as possible the perfect state. One of their suggestions had reference to this comfortable little fiscal arrangement whereby the gas consumers bore the cost of the public lighting; it being proposed that, at the end of the current financial year, the cost should be put on to the proper shoulders, and the ratepayers be made to each bear his share of the expense of a necessity which all the inhabitants enjoy in common with those who are also gas consumers. The amount which the gas undertaking has been paying for this particular public service is about the middle figure between £5000 and £6000; and for a large number of years they have borne this injustice. Reparation for the past cannot well be made; but, as seen, there is to be an amendment for the future—that is, if a certain event comes to pass, to which allusion will be made presently.

Before dealing with that event, let us glance at some of the arguments that are often advanced in favour of the perpetuation of the present anomalous arrangement, which exists not only in Rochdale, but in other places; and thus a simple conversion of names will make what is written here apply similarly to those towns. The most prominent of the arguments are that high rates are an injustice, that the relief of the gas consumer from the burden of the public lighting means the further raising of the rates, and that this menaces the future prosperity of the borough. Now, in the first place, if the present rates of Rochdale are high, the gas undertaking and the gas consumers (as such) are quite innocent of having made them so; and why they should suffer for other people's extravagances, has yet to be shown. On the contrary, the very payment of the cost of public lighting in addition to the contribution of substantial profits to the rates is proof that the gas consumers have, with great liberality, done much to counteract the effect of the prodigal expenditure that has brought about the high rates. That they have done so involuntarily is true; but that they have done it, the facts alone will not admit of any contradiction. The argument, however, brings us face to face with this outrageous position—that the gas consumer has not only had to pay the high rates, but has, through the cost of the public lighting being on his shoulders, had to pay more to the general expenses of the borough than those ratepayers who are not gas consumers. Not only so, but the larger the house or business premises of the ratepayer, the greater the amount he has had to pay of the high rates; and the larger his house or business establishment, the more gas has he had to burn, and consequently the greater has been his contribution to the public lighting. Who, then, suffers an injustice—the gas consumers, or the ratepayers generally? He must have a queer head who can find any justice in the arrangement so far as the gas consumers are concerned. In what has been written is found the answer to the second point, Will the relief of the consumers from the cost of the public lighting bring about an injustice, or repair one? The question has only one reasonable answer.

This carries us to the third point. Will the relief of the gas consumers, and the increase of the rates which will naturally follow by the public lighting being charged to the whole of the ratepayers (but which increase can only be comparatively small) menace the future prosperity of the town? We do not believe it, and therefore do not think there will be the slighest drag put upon the development of industry. Our feelings, in fact, rather incline the other way. It has already been shown that under the existing system it is the manufacturers and the large shopkeepers who suffer most. They pay more rates, consume more gas, and so contribute to a larger extent than other people to the public lighting. If these large consumers of gas obtain a reduction in price as the result of the change, and the reduction be equivalent to the amount they have been paying per 1000 cubic feet for the public lighting, it will more than counterbalance any consequential increase in the rates which they will have to bear in common

with the other ratepayers. Their new position will certainly be better than the existing one; and it will not be a difficult matter to prove this both to their satisfaction and that of newcomers. One fact—and an important one—that is overlooked in the discussion of this subject is that the tendency now is to use gas more and more in industrial operations; and therefore as the consumption of a manufacturer grows under the present order of things, the more does he contribute to the cost of the public lighting, as compared with his neighbours whose gas consumption keeps at a uniform level. To put it another way. The burden of the public lighting on an individual consumer increases with the growth of his gas consumption; and all consumers of smaller quantities pay in proportion less of the cost of public lighting as their consumptions recede from that consumer's. Of course, this assumes uniformity of price. It should not be overlooked, too—and the point is being emphasized day by day—that it is bad policy to charge anything on to a municipal gas undertaking that is antagonistic to its best interests by assisting to keep up the price of gas. In large industrial centres, the gas undertakings depend very considerably on the manufactories. They take a great part of the output of gas; and it is these manufactories in which will be installed producer gas directly the owners find that the corporation cannot supply them with a gas as economical for their purposes. The gas undertaking in a manufacturing town has three competitors—electricity, oil, and producer gas; and the last-named should not on any account be forgotten in looking ahead.

This calls to mind the point that nearly every municipality owning a gas undertaking has also established an electricity supply; and in those cases where the public lighting is a charge on the gas undertaking, to be consistent the price of electricity ought to be put at such a figure that the electricity consumers also bear a proportion of the cost of the street lighting. It has not come to our knowledge that this has been done in a single case; but it has come to knowledge that many gas consumers have transferred their custom to the electric light undertaking—perhaps not with the intent, but with the effect that they have escaped the contribution to the cost of the public lighting. The result is that the number of ratepayers in towns that enjoy free street lighting at the expense of the gas consumers is a growing quantity. With the introduction of electricity, there was less justification for the continuation of the system than before—difficult though it was to even adumbrate any justification previously, excepting perhaps in one respect—that this means of getting rid of some of the profits of a gas undertaking was at one time a way of cheating the country out of revenue from income-tax. But the Income-Tax Commissioners have got alongside this little artifice, and will not further allow the deduction. What, however, has been happening in Rochdale in respect of the relations of the gas consumer and the electricity consumer to this particular question was told in the Council the other day by Mr. Jones in a pellucid sentence, which is eloquent as to the injustice that has been going on. "It seems rather 'hard lines,'" said Mr. Jones, "that the Corporation should have been giving people who use electricity an article below cost price up to now, and yet be charging another section of the community 25 per cent. profit." After this, nothing more need be said on the point. But what has been remarked as to electricity applies in part to oil, and entirely so far as injustice to gas consumers is concerned.

Coming to the last, and what is perhaps at Rochdale the most important, point in view of the change back to the common fund coffer for the wherewithal to pay for the public lighting, is as to the future of the gas consumer. It must, as a right, follow the change that the price of gas should be reduced; otherwise the consumers will be in a worse position than they are in to-day when paying for the whole public lighting. They have suffered loss from an iniquitous policy in the past; and they must not be victimized still more when the fate decreed for that policy has been met. Unless the consumers obtain a reduction, and one commensurate with the cost of the public lighting, what will happen? They will still be supplying the profits from which the public lighting has been paid, and will have to pay the lighting rate in addition, from which they are now exempt, because they are paying their share of it, and other people's too, in another way. Against the proposition that the £5000 to £6000 should—the present conditions in the gas industry continuing—go to the consumer at the end of the current financial year, there cannot possibly be a countervailing argument. The Rochdale people have taken the first step, tardily it is true, in correcting an inequitable state of things; and it is to be hoped they will show the fullness of their sense of equity by giving to the gas consumers as promptly as may be that which properly belongs to them. We have dealt somewhat fully with this subject, because it is one in which more municipalities than Rochdale are interested; but Rochdale comes in well *exempli gratia*.

**Engine Driving with Wood Gas.**—According to the "Iron and Coal Trades Review," the Fauge wood-gas producer, of which an illustrated description is given, has been employed for some time, with satisfactory results, in supplying two 50-horse power gas-engines in one of the largest works in France. Another generator of this type, designed for a 200-horse power engine, has been installed. The consumption of wood (neither air nor kiln dried) per horse power is stated to be less than 5 lbs.

## BLAST-FURNACE GAS-ENGINES.

Of recent times a considerable amount of attention has been directed to the utilization of blast-furnace gases by means of large gas-engines; and descriptions of types designed for this purpose have appeared in different numbers of the "Journal." Mr. William H. Booth is of opinion that a very great deal more will be heard of this subject; for writing in "Cassier's Magazine" this month, he states that the gas-engine must inevitably be the future user of blast-furnace gas, and that if the gas-furnace were utilized to its full capacity, it would provide power in immense quantities, which could be electrically transmitted by high-tension lines to centres of large industry or population. This transmission can only be effected electrically; and hence the demand which is growing up for large gas-engines that will run steadily enough to drive alternating-current machines. What Mr. Booth has to say on the subject is put in a very readable form; and the value of the article is much enhanced by the many excellent illustrations which accompany it of the engines he describes.

The author remarks that probably the greatest impetus has been given to the large gas-engine by the Thwaite system of blast-furnace gas utilization; this method of cleansing the gas having now received universal recognition as an essential part of the process. There are now, it is stated, about fifty firms building gas-engines of 200-horse power and upwards; but most of the large ones have been constructed by, or for, Continental firms—British and American ironmasters having been slow to appreciate the advantages of blast-furnace gas as a source of power, and having thus deprived our gas-engine makers of the opportunity of turning out machines of large power for which they are as competent as other firms. Seven years ago, Mr. Booth made the first public and independent test of the first gas-engine ever worked with blast-furnace gas. This was a small engine of under 20-horse power, at the works of the Glasgow Iron and Steel Company, at Wishaw, where it was, and is, used for driving the electric light plant for the furnaces, yard, and offices. After this, progress was rapid on the Continent. In Great Britain, however, it has not been so satisfactory; and "the curious sight is seen of gas-producers being put up to generate gas for power purposes—a proceeding not unlike pumping water uphill in order to get a water power."

In describing the main features of some of the larger engines now being manufactured, Mr. Booth says that one of the Crossley 100-horse power engines is guaranteed to run with a mechanical efficiency of not less than 85 per cent. with producer gas, consumes not more than 1 lb. of fuel per effective horse-power-hour, and is governed within a 3 per cent. speed variation between no load and full load. Messrs. Fielding and Platt have a four-cylinder vertical engine which is built up to 750 brake horse power. This gives great cyclical regularity, and is able to promptly meet sudden demands for power. A 500-horse power tandem engine built by the Premier Gas-Engine Company, fitted with a third, or scavenging, cylinder, when tested at 489 indicated horse power with Mond gas containing 143·8 British thermal units per cubic foot, showed an average effective pressure of 108·25 lbs., 368 brake horse power, and a thermal efficiency of 30·28 per cent. The Company have also a new engine built in sizes from 300 to 1000 indicated horse power; while four-cylinder engines of the same type will be made up to 2000 indicated horse power.

Referring to the Körting gas-engine (as manufactured by Messrs. Mather and Platt and Messrs. Fraser and Chalmers), Mr. Booth remarks that this is "a resuscitation of an old idea which failed of commercial success, like many good things that came before their time." As made in Great Britain, it is the Clerk engine again in principle. Single-cylinder engines of this type are built in units from 400 to 1500 brake horse power; and by duplicating these powers in a twin cylinder, engines of from 800 to 3000 brake horse power are obtained. Tangye's 200 brake horse power three-cylinder vertical gas-engine, working on the "Otto" cycle, is capable of developing 225 brake horse power with producer gas; while engines of the same type are being built capable of developing 350 maximum brake horse power. Two other illustrations which accompany the article show a 100-horse power engine made by the Forward Engineering Company, and "the largest gas-engine in the world"—the 1200-horse power tandem gas blowing engine built by the Société Anonyme John Cockerill, of Seraing. This latter has two cylinders, and a working speed of 80 revolutions a minute; the total weight of the machine, including the 33-ton fly-wheel, is 237 tons. There is also a picture of the Thwaite gas-blowing engine at the Clay Cross Iron-Works, in which two horizontal power cylinders drive a central vertical air-blast cylinder; the blowing of the furnace being, as the author remarks, a particularly suitable first form of gas utilization.

In this notice we have merely given a very brief outline of some of the matters dealt with by Mr. Booth in his article, which, with the illustrations, occupies more than twelve pages of "Cassier's Magazine." Having thus endeavoured to convey to our readers some idea of the scope of the communication, it only remains to recommend those who may be interested in this development of the gas-engine to procure a copy of the article, which forms a very fair treatise on the subject.

## AMMONIA AND CYANIDES FROM THE AIR.

THE problem of producing either ammonia or cyanogen compounds on a commercial scale from the nitrogen of the atmosphere, has long attracted the inventive talent of chemists, and rightly so, because a fortune awaits him who arrives at a satisfactory solution of it, and is able to exploit his discovery. Hitherto the numerous processes which have from time to time been brought forward for the fixation, as it is termed, of atmospheric nitrogen, have failed on a commercial basis, by reason of the too great cost of the product when ultimately secured. The cost has been incurred partly through complication of the processes, involving heavy working charges, partly in large expenditure of energy for the fixation, and partly in the employment of costly media for effecting it.

Now, however, a process is being exploited under the auspices of the well known German firm of Siemens and Halske, which is said to yield cyanogen and other nitrogenous compounds at a cost at which they can compete with the present commercial products, mostly derived from coal, and to a large extent incidentally in the manufacture of coal gas. Hence it behoves gas managers to watch the developments of this process, which is described in two papers, by Dr. A. Frank and Dr. Erlwein, of which abstract translations are given elsewhere to-day (p. 677. The medium by which the fixation is accomplished is, in this instance, calcium carbide, or the mixture of carbon and lime which yields the latter. It is not the first time that calcium carbide has been held out as a material likely to affect detrimentally the present position and prospects of the gas industry; and it may be that it is again lending itself to a false alarm. We have as yet no information as to the electrical energy which is required for the production from atmospheric nitrogen by means of the new process of the "lime-nitrogen" equivalent of a ton of sulphate of ammonia, or of a ton of potassium cyanide; and until this is forthcoming it will be difficult to estimate the extent to which the working of the process on an industrial scale may affect the present producers of sulphate and cyanides.

So far as the gas industry is concerned, sulphate of ammonia and cyanogen compounds are bye-products, which will be produced so long as the price obtainable for them covers the expenses involved in working them up from the crude bye-products of gas manufacture. The supplies of them from gas-works will not therefore be readily driven out of the market by supplies obtained through any process of which they are the staple products. But such a process—as, for instance, the new one to which we are directing attention—may seriously reduce the profits which gas-works at present realize by working up their gas liquor and recovering cyanogen. The outlook, however, must be far worse for processes in which the returns from ammonia and cyanogen products are relatively large—as, for instance, with the Mond gas process. A serious depression in the value of sulphate of ammonia, arising from the introduction of a commercially successful process for fixing atmospheric nitrogen, would inevitably make Mond gas a very costly luxury. It must in this connection be borne in mind that the Mond gas producer is primarily an apparatus for making ammonia from steam and the nitrogen in slack coal, and that the Mond gas is but a bye-product, of which the very composition is dictated by the necessities of ammonia production. If Dr. Frank and Dr. Erlwein have in reality found a means of producing as good a nitrogenous fertilizer as sulphate of ammonia from atmospheric nitrogen at a low cost, the prospect before the Mond gas concerns is a poor one indeed; for no one can pretend that Mond gas is worth producing as the staple product. With coal gas, it is otherwise, though even here a marked depression in the value of sulphate would be seriously felt.

## FROM EARLY VOLUMES OF THE "JOURNAL."

### Oct. 10, 1849.

NOVEL MODE OF MANUFACTURING ILLUMINATING GAS.—A very interesting experiment was recently tried by MM. Livenais, of Bordeaux, and Dr. Berhardt, at the chemical lectures of the faculty in Paris, in the presence of several members of the Academy, and many other *savants* and manufacturers. The fact to be demonstrated was that, by the decomposition of grape-skins and wine-lees in a close vessel, carburetted hydrogen gas would be disengaged of such a superior quality as to lead to the supposition that it might be used to advantage in place of the gas ordinarily obtained from coal and resin. Half a kilogramme (about 1 lb. English), upon being put into an incandescent retort, furnished in less than seven minutes 200 litres (a litre equals about a quart English) of carburetted hydrogen gas. This gas, on being supplied to a burner, burned with a bright-white light. It is entirely free from smell, and the flame may be raised to a great height without smoke. A second experiment made with dried wine-lees gave an equally satisfactory result. By this simple means, anyone may manufacture his own gas in his own house at a very trifling expense.—*Technologiste.*

### Dec. 10, 1849.

The event, the approach of which we have long foreseen, has at length arrived; the Corporation of the City of London having granted the prayer of the Great Central Gas Consumers' Company for permission to lay down their mains in the streets and thoroughfares under their jurisdiction. The benefits which the public will derive from this resolution are more than doubtful; but the ruin it entails upon the proprietors of the Metropolitan gas-works is certain. It is another added to the many previous examples that something beyond lethargic confidence is requisite to combat active and unscrupulous opponents. Had our warning voice been heard and acted upon, it would have saved the two respected bodies, which have now been sacrificed to the Moloch of public clamour in the hope that the other members may escape. Be not deceived, gentlemen. Do you think that the gas consumers of the Strand, Regent Street, Oxford Street, and other populous localities, will long remain quiet spectators of what is passing in the City of London? If you do, you are grievously mistaken; and, if you can read the future, you will instantiy, and *without being asked*, reduce your price of gas to 5s. per 1000 cubic feet. The present situation of the City Companies demonstrates the importance of knowing *when* to yield, and the value attached to an unasked-for concession. Unjust concessions, wrung at the eleventh hour under the pressure of circumstances, far from proving that the original demands were reasonable, resemble more those of the poor traveller who, to save his life, gives up his purse to the armed highwayman, and is as little thanked. The Corporation of the City of London, in deciding this question without inquiry, and without permitting evidence to be produced to rebut the *ex parte* statements to which they have lent too ready an ear, have committed an injustice which will one day react upon themselves. The laugh and jeer which greeted the appeals of the widows and orphans, about to be rendered destitute by their act, were unworthy of a deliberative assembly—the more so as that corporate body draws from the public itself, under the fiction of "Orphans' Dues," a sum of little less than £200,000 a year, of which £20,000 is contributed by gas companies beyond their jurisdiction. When this tax was imposed, widows and orphans were less the objects of the sneers of the Corporation of the City of London than they appear to be at the present day.

### Jan. 10, 1850.

The Directors of the Great Central Gas Company have accepted a tender from Messrs. Peto and Betts, the eminent contractors, to erect the whole of their works, laying mains, &c., for the sum of £106,880. The streets are only to be opened for mainlaying at night, the pavement being made good before eight o'clock in the morning, and the whole work to be finished by the 24th of June next. The contractors agree to receive one-half the amount in paid-up shares. A contract is also entered into with Mr. Croll to manufacture at their works the whole of the gas they may require, delivered into their gasholders at 1s. 4½d. per 1000 cubic feet, for five, seven, fourteen, and twenty-one years, at the option of the Company. The works are to be commenced forthwith.

## PERSONAL.

Mr. GEORGE KEILLOR, of Peterhead, was selected last night to succeed Mr. Forbes Waddell as Manager of the Broughty Ferry Gas-Works. There were 34 applicants for the position.

Mr. ALPIN M'GREGOR, son of Mr. J. M'Gregor, the Manager of the Mold Gas and Water Works, has obtained the appointment of Assistant at the Colne (Lancs.) Gas-Works, applications for which were recently invited in the "JOURNAL." Mr. A. M'Gregor was a pupil of Mr. J. C. Belton, of Chester.

## OBITUARY.

Mr. H. Wimhurst, of Sleaford, will have the sincere sympathy of his many friends in the gas profession in the bereavement he has just sustained by the death of his eldest daughter, Mrs. ALYS BAYES, who died on the 4th inst., after a few months' illness. Mrs. Bayes was only in her 28th year.

We deeply regret to have to record the death, which took place on Monday of last week, at Aberfoyle, of Mr. JAMES M. GALE, M.Inst.C.E., formerly Water Engineer to the City of Glasgow. Mr. Gale, who was in his 73rd year, had for some time been in failing health; and it will be remembered that on this account he resigned his position at the end of last year, after having been connected with the Glasgow water supply for between fifty and sixty years, during forty-three of which he was Chief Engineer. Some particulars of his work were given in the "JOURNAL" for Dec. 23 last, when announcing his retirement.

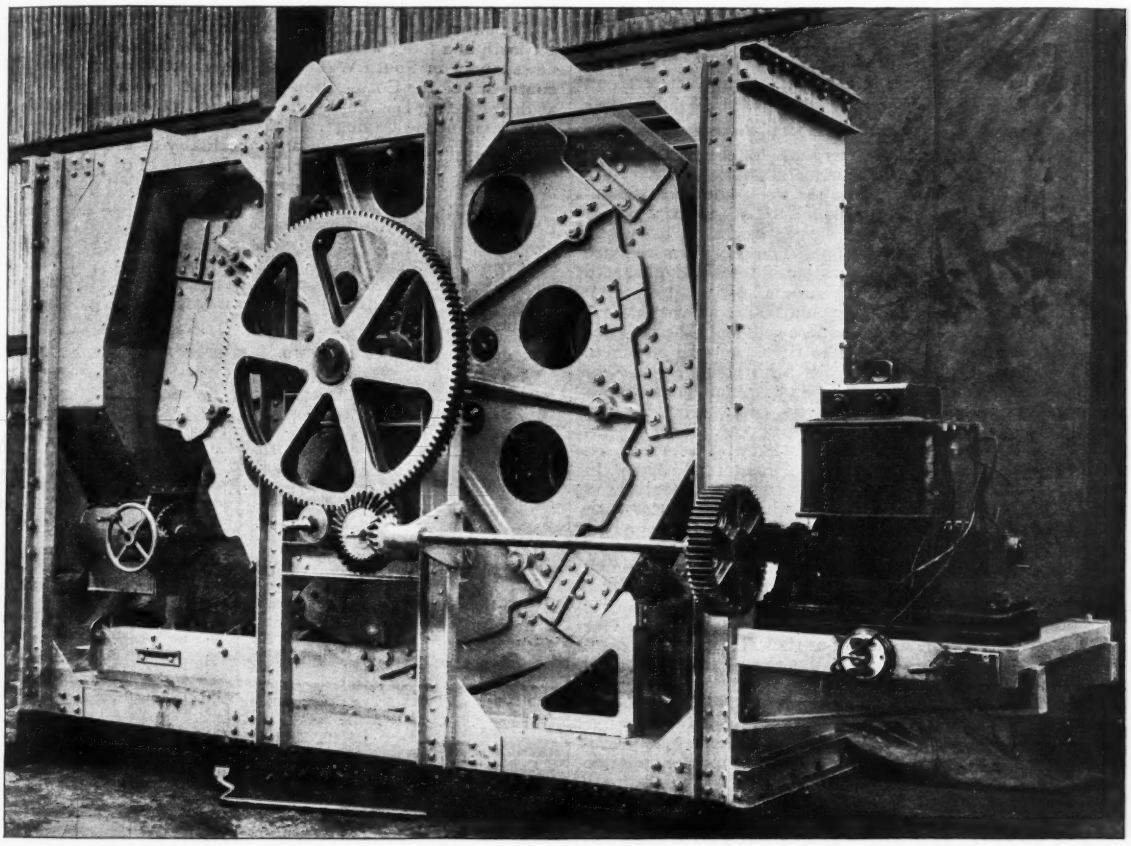
---

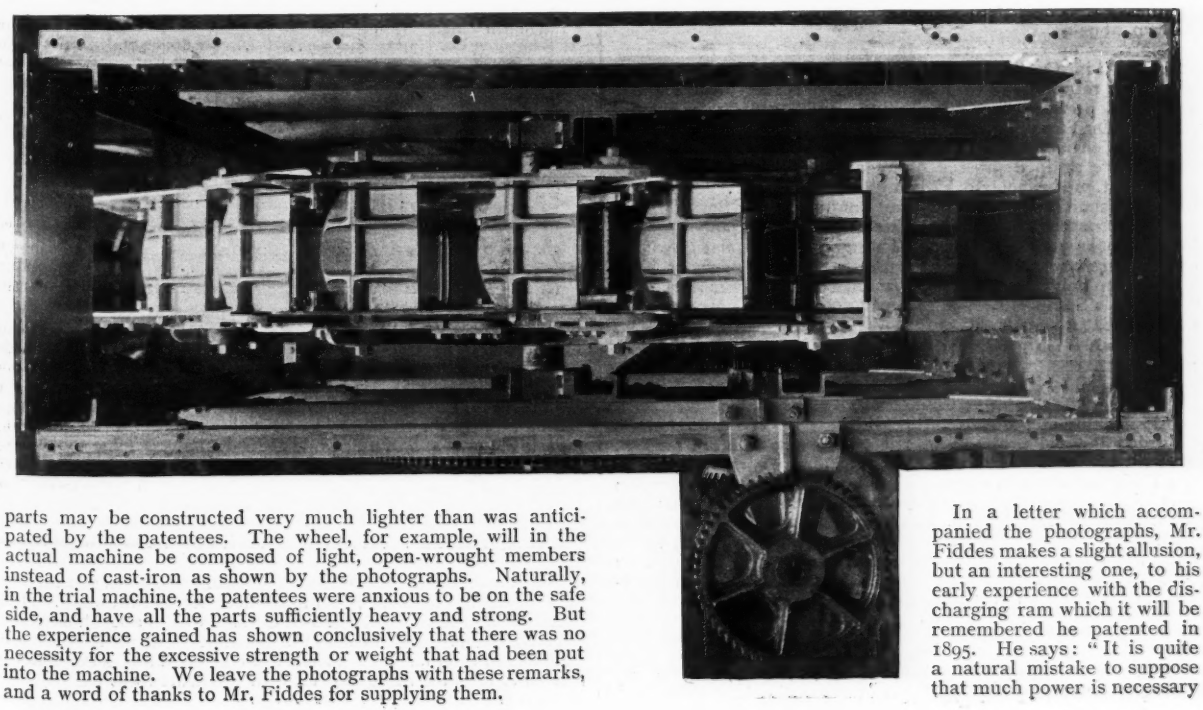
According to the "Kölnische Zeitung," the briquette factories of Germany are in a bad position this year, as the unprecedented rise in the price of pitch increases the cost of production to such an extent that they are working at a loss. The prosperous state of the iron industry promises, however, to afford some relief, as it greatly encourages the erection of coke-furnaces.

# THE FIDDES-ALDRIDGE COMBINATION RETORT CHARGING AND DISCHARGING MACHINE.

It may be some months—at all events until after the coming winter's pressure in gas making is over—before one of the Fiddes-Aldridge combination retort charging and discharging machines can be seen in operation under ordinary working conditions; and therefore we have suggested to Mr. William Fiddes to allow us to publish at once photographs of the trial machine. The new arrangement was described last week; but in reading that description in conjunction with the photographs presented to-day, gas engineers will fully appreciate the fact that the latter merely illustrate the machine as first built for trial, and not the final standard design, such as the patentees are about to have constructed for permanent use. First experimental machines are, of course, never anything more than a rough embodiment of the invention—they cannot be otherwise; and the experimental work teaches where refinement and improvement can be effected. It has been so in this case; but nevertheless the photographs are interesting, even though they only present to view the machine in an immature state.

In the few notes published last week, reference was made to the experience with the trial machine at the Bath Gas-Works; and that experience, we are informed, proved that the working





parts may be constructed very much lighter than was anticipated by the patentees. The wheel, for example, will in the actual machine be composed of light, open-wrought members instead of cast-iron as shown by the photographs. Naturally, in the trial machine, the patentees were anxious to be on the safe side, and have all the parts sufficiently heavy and strong. But the experience gained has shown conclusively that there was no necessity for the excessive strength or weight that had been put into the machine. We leave the photographs with these remarks, and a word of thanks to Mr. Fiddes for supplying them.

In a letter which accompanied the photographs, Mr. Fiddes makes a slight allusion, but an interesting one, to his early experience with the discharging ram which it will be remembered he patented in 1895. He says: "It is quite a natural mistake to suppose that much power is necessary

to force a charge of coke out of a through retort from one end. With my first telescopic ram, the coke from the 7 cwt. charges was discharged easily in 15 seconds by two men—one man alone frequently did it in 30 seconds. If you consider the little power required to drive pushplate conveyors over 200 feet in length (as they are installed in some of the large works), you can then realize what power would be required in order to drive one that was only 20 feet long."

Gas engineers will look with much curiosity for the machine in its developed form, and an account of a demonstration of its working.

## THE GAS AND WATER STOCK MARKET.

**(For Stock and Share List, see page 692.)**

THE Stock Exchange continues in a very idle condition; and, on the whole, the tendency has been in the downward direction. The settlement was got over easily, for the speculative position is on a very small scale. Brokers, however, had to pay more money for their fortnightly advances. The monetary outlook is affecting all departments; and the feature of the week has been the depression of gilt-edged stocks. Consols fell to 89 1/16 for money and 89 1/8 for the settlement; and though a rally has taken place, yet the market is by no means a strong one. The enormous increase of first-class stocks bearing a higher rate of interest, coupled with the large speculative position for the rise, is now weighing upon the premier security, and bringing down all other stocks in sympathy. The Gas Market has also suffered, though slightly; for nearly all the changes recorded are in the downward direction. On the whole, however, the market has been steady. Gaslight ordinary was fairly active between 85 and 87, finally showing a fall of two points on the week. The 4 per cent. preference also lost 2—being quoted 102-105; but the 3½ per cent. maximum has risen to 84-86. South Metropolitan has likewise been offered—the ordinary falling to 119-121, and the debentures to 87-89. In the Suburban and Provincial group, Newcastle and Gateshead consolidated were quoted 103-4 locally, which was better than the London price; but the debenture stock fell 1, to 98-99. Brighton and Hove issues are now quoted *ex div.*, which accounts for the fall in the price to 207-212, and the "A" stock to 145-150; the latter price being 2 per cent. above the lowest point. Hastings and St. Leonards stock is also quoted *ex div.*; but the price is unchanged. The Directors of the British Gas Company have declared a dividend at the rate of 10 per cent. for the half year ending June 30; but the shares have not been affected. Movements in the securities of Foreign companies were slight. Imperial Continental stock was sold down to 200-203, which shows a fall of 2; while, on the other hand, there was a demand for River Plate, which marked a further improvement of ¼, to 11½-11¾. Business was also recorded in San Paulo at 11½, and Continental Union preference at 140¾. Water stocks still show heaviness, although the market has been very quiet. The chief movement is a fall of 10 in Southwark and Vauxhall ordinary, to 225-235. New River shares are also 5 down, at 385-395; and Lambeth 10 per cent. maximum 2, at 292-297. West Middlesex debenture stock is quoted *ex div.*; and the price is 1 down, at 92-95.

The daily operations were: In Gas, there was a reactionary movement in Gaslight ordinary and preference on Monday, which fell respectively to 104½ and 87. Water stocks showed renewed depression, New River falling 5, and Southwark and Vauxhall 2½. On Tuesday, Gaslight ordinary was again active; while Imperial Continental fell 1½. Water stocks were steady. Gaslight stocks were again depressed on Wednesday; the ordinary and 4 per cent. preference stocks being quoted 1 lower. There was likewise a similar decline in Imperial Continental and South Metropolitan debentures; but River Plate ordinary was quoted higher. Water stocks were again quiet. Thursday was a quiet day; the only change being a fall of 2 in Lambeth water 10 per cent. On Friday, the only feature was a rise of 2 in Brighton and Hove "A;" while South Metropolitan ordinary fell 1. There was little doing on Saturday; and Gas and Water stocks were unaltered.

**North of England Gas Managers' Association.**—The 53rd half-yearly meeting of the Association will be held at Darlington, on Saturday the 3rd prox., under the presidency of Mr. Frank P. Tarratt. On arrival at Darlington, the members will proceed to the Technical College, where (by the kindness of the Corporation Gas-Works Committee) light refreshments will be provided; and the Chairman (Alderman T. M. Barron) and the members of the Committee will welcome the Association to the town. The President will deliver his inaugural address; and then a paper, on "Constructional Details and Costs of Recent Extensions (1900-1902), with Notes on Working Results at Tynemouth Gas-Works, North Shields," will be read by Mr. A. Clement Hovey. A visit will afterwards be made to the gas-works, and to the gasholder tank under construction; and (time and weather permitting) there will be a drive to Walworth and Piercebridge. Dinner at the King's Head Hotel forms part of the programme.

# TECHNICAL RECORD.

## PUBLIC LIGHTING STATISTICS.

**An Interesting Compilation by Mr. Thomas Canning.**

Members of the gas profession generally will, we feel sure, be grateful to Mr. Thomas Canning, the Engineer and Manager of the Newport (Mon.) Gas-Works, for the trouble to which he has put himself to prepare a table giving a number of statistics as to the public lighting of some large towns of England, under Corporation as well as Company control.

The circumstances under which the figures were compiled are set forth in a letter which Mr. Canning addressed to the principal newspapers in South Wales and Monmouthshire, in view of the course which the Corporation of Newport were advised to adopt at their meeting last Tuesday, of increasing the number of electric arc lamps in the borough. Mr. Canning rightly considered that the ratepayers should have an opportunity of seeing what other large cities and boroughs are doing in respect of public lighting. The table (below) was compiled from information quite recently obtained from the authorities of the places named; and Mr. Canning remarks that in most of them prolonged trials were made of electric lighting compared with gas—as to cost and efficiency—before determining that gas should be the staple public illuminant. In many of the cases, too (such as Liverpool), the electricity supply is in the hands of the Corporation, and the gas for public lighting is purchased from a Company.

PUBLIC LIGHTING BY GAS AND ELECTRICITY IN THE FOLLOWING ENGLISH CITIES AND BOROUGHS.

| Name of Town. | Total Number of Public Lamps. | Number of Gas-Lamps. | Number of Electric Arc Lamps. | Number of Incandescent Electric Lamps. | Number of Incandescent Gas-Lamps, 1902. | Number of Incandescent Gas-Lamps, 1903. | Increase in Incandescent Gas-Lamps. | Decrease in Incandescent Gas-Lamps. |
|---|---|---|---|---|---|---|---|---|
| Birmingham | 19,152 | 19,152 | .. | .. | 4,171 | 5,489 | 1,318 | .. |
| Bolton | 5,667 | 5,659 | 8 | .. | 1,008 | 1,008 | .. | .. |
| Brentford (*a*) | 5,985 | 5,985 | .. | .. | 3,393 | 3,733 | 340 | .. |
| Cambridge | 1,381 | 1,380 | 1 | .. | 1,180 | 1,181 | 1 | .. |
| Coventry | 1,054 | 1,016 | 38 | .. | 926 | 1,021 | 95 | .. |
| Croydon | 2,594 | 2,144 | 450 | .. | 1,080 | 2,246 | 1,166 | .. |
| Eastbourne | 1,380 | 1,300 | 80 | .. | 1,000 | 1,240 | 240 | .. |
| Folkestone (*b*) | 1,116 | 1,050 | 66 | .. | 1,064 | 1,050 | .. | 14 |
| Halifax | 4,420 | 4,350 | 70 | .. | 1,400 | 1,620 | 220 | .. |
| Huddersfield | 3,403 | 3,313 | 38 | 52 | 3,000 | 3,313 | 313 | .. |
| Liverpool | .. | 19,639 | .. | .. | 12,774 | 13,213 | 439 | .. |
| London— | | | | | | | | |
| Commercial Co., Stepney (*c*) | 5,783 | 4,850 | 933 | .. | 1,100 | 1,384 | 284 | .. |
| Crystal Palace District Co. | 3,220 | 3,160 | 60 | .. | 3,122 | 3,160 | 38 | .. |
| Gaslight and Coke Co. | .. | 49,263 | .. | .. | 13,005 | .. | .. | .. |
| South Metropolitan Co. | .. | 21,746 | .. | .. | 17,304 | .. | .. | .. |
| Tottenham and Edmonton Co. | 3,255 | 3,255 | .. | .. | 2,640 | 2,779 | 139 | .. |
| Wandsworth and Putney Co. (*d*) | 2,102 | 2,096 | 6 | .. | 2,029 | 2,096 | 67 | .. |
| Portsmouth (*e*) | 1,939 | 1,939 | .. | .. | 1,000 | 1,600 | 600 | .. |
| Ramsgate | 1,023 | 1,023 | .. | .. | 1,018 | 1,023 | 5 | .. |
| Sheffield | 9,048 | 9,040 | 8 | .. | 3,326 | 4,568 | 1,242 | .. |
| Southport | 2,353 | 2,286 | 67 | .. | 1,716 | 1,750 | 34 | .. |
| Tunbridge Wells | 846 | 570 | 80 | 196 | 570 | 570 | .. | .. |

(*a*) Ordered to convert 538 flat-flame gas-lamps to incandescent gas-lamps.

(*b*) The difference of fourteen less accounted for by the erection of five Kitson lamps.

(*c*) Steps now being taken to convert the ordinary gas-lamps into incandescent gas-lamps.

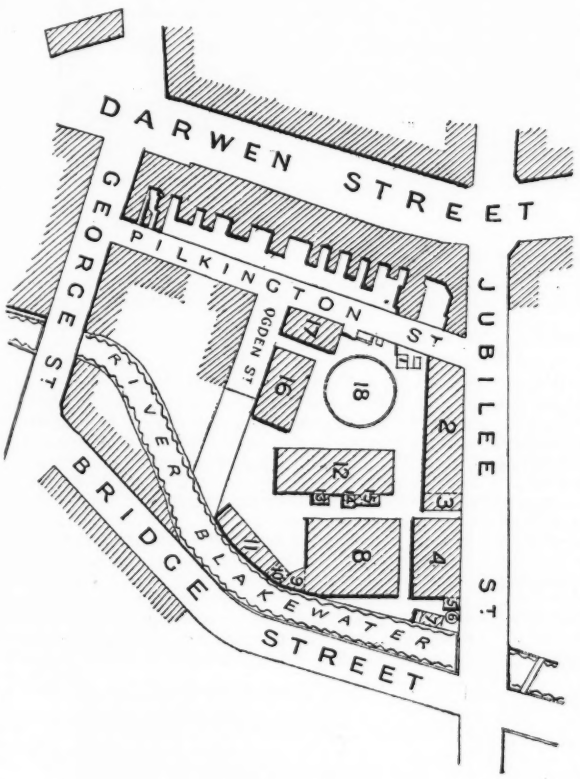
(*d*) These six electric lamps are lighting a private road, the property of the Electric Light Company.

(*e*) Ordered up to 2000 at the time of information.

The whole of the new Islington lighting contract, Mr. Canning points out, was fixed recently for Kern gas-burners and mantles. Holborn is entirely lighted at the present time by incandescent gas-lamps. The important streets of Manchester are practically lighted throughout by clusters of No. 4 Kern gas-burners. The same is the case at Salford; while at Newcastle-on-Tyne 200 of the large shadowless self-intensifying Welsbach gas-lamps have been installed and a further order has just been given for 300 more. Edinburgh is in treaty at the present moment with the Welsbach Incandescent Gas-Light Company for the installation of incandescent gas lighting. As a contrast, Mr. Canning points out that at Newport the total number of public lamps is 1203; the number of gas-lamps, 1125; the number of electric arc lamps, 76; incandescent electric lamps, 2; and incandescent gas-lamps, 107. The proposition of the Newport Town Council was to abolish 85 ordinary flat-flame gas-lamps and 8 incandescent gas-lamps, and establish in their place 68 electric arc lamps. The Gas Company offered to light the same district with intensified gas at a saving of £831 per annum to the Corporation.

# THE MANCHESTER GAS INSTITUTION AT BLACKBURN.

From various directions—in nearly all instances in conformity with the railway arrangements made by the Hon. Secretary (Mr. H. Kendrick)—the members of the Manchester District Institution of Gas Engineers arrived in Blackburn last Saturday morning, on a visit to their President (Mr. S. R. Ogden), the Engineer of the Corporation Gas-Works. The party, whom he met at the Railway Station, must have numbered quite 60. The arrangements which had been made for the occasion by Mr. Ogden and the Committee were perfect in every detail. Char-a-bancs were in attendance at the town gas office; and strictly in accordance with the programme the party left at 11.30 for the Greenbank Gas-Works, which had been kindly thrown open to their inspection by the Corporation Gas Committee. Before doing so, however, the members received a hearty welcome to the town from the Chairman of the Gas Committee (Mr. J. H. Hartley). The time allotted to the visit to the works was none too long; there



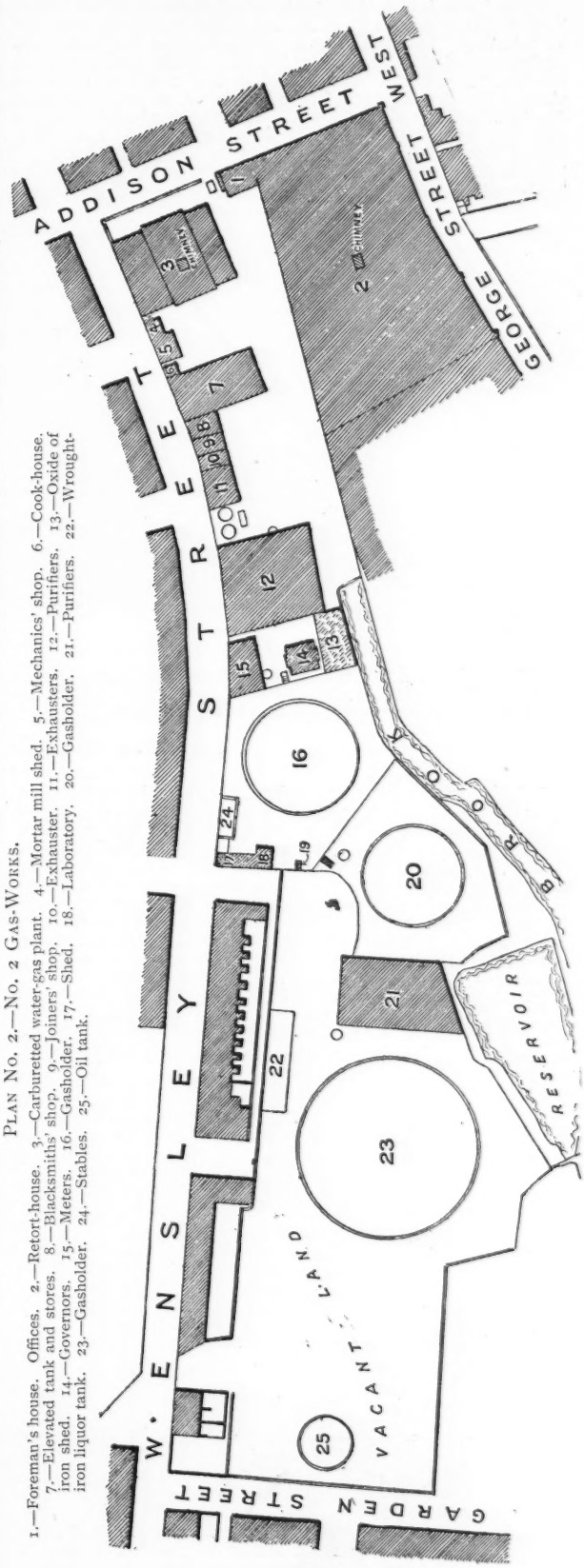

PLAN NO. 1.—THE OLD NO. 1 GAS-WORKS.

1.—Office. 2.—Coal-shed. 3.—Meter-house. 4.—Purifiers. 5.—Purifying-house. 6.—Chimneys. 7.—Boiler-house. 8.—Retort-house. 9.—Cook-house. 10.—Pump-house. 11.—Liquor-tank. 12.—Purifier. 13.—Meter-house. 14.—Chimney. 15.—Boiler-house. 16.—Coal-shed. 17.—Lime-shed. 18.—Gasholder.

being so much of special interest to the President's colleagues to be seen and examined there. Mr. Ogden was ably assisted by Mr. Davis, the Deputy Manager of the works, in conducting the party through the works.

Each member of the party was presented with a souvenir pamphlet by Mr. Ogden. In it were a number of photographic views of different portions of the new works together with three plans, which show the development of the gas undertaking in its different stages. Some of the former and the latter we have reproduced to-day. The descriptive matter accompanying the illustrations was of a very modest character; but it will suffice, with a few additional notes, to explain the views. In the first place, it is of historical interest to recall the fact that the old Blackburn Gaslight Company was formed in the beginning of 1818—in fact, in the introduction of coal gas to the inhabitants, Blackburn was only preceded in Lancashire by Stonyhurst College, Preston, and Manchester, and co-incidentally with Blackburn gas was supplied in Liverpool and Bolton. The original works (see plan No. 1) were erected on a spot well chosen at the time for its central situation and its water privilege; and the site was in continuous use for gas manufacture until 1900, when it was decided to remove to a position better adapted for works.

In 1825, it was found necessary to erect other works; and this



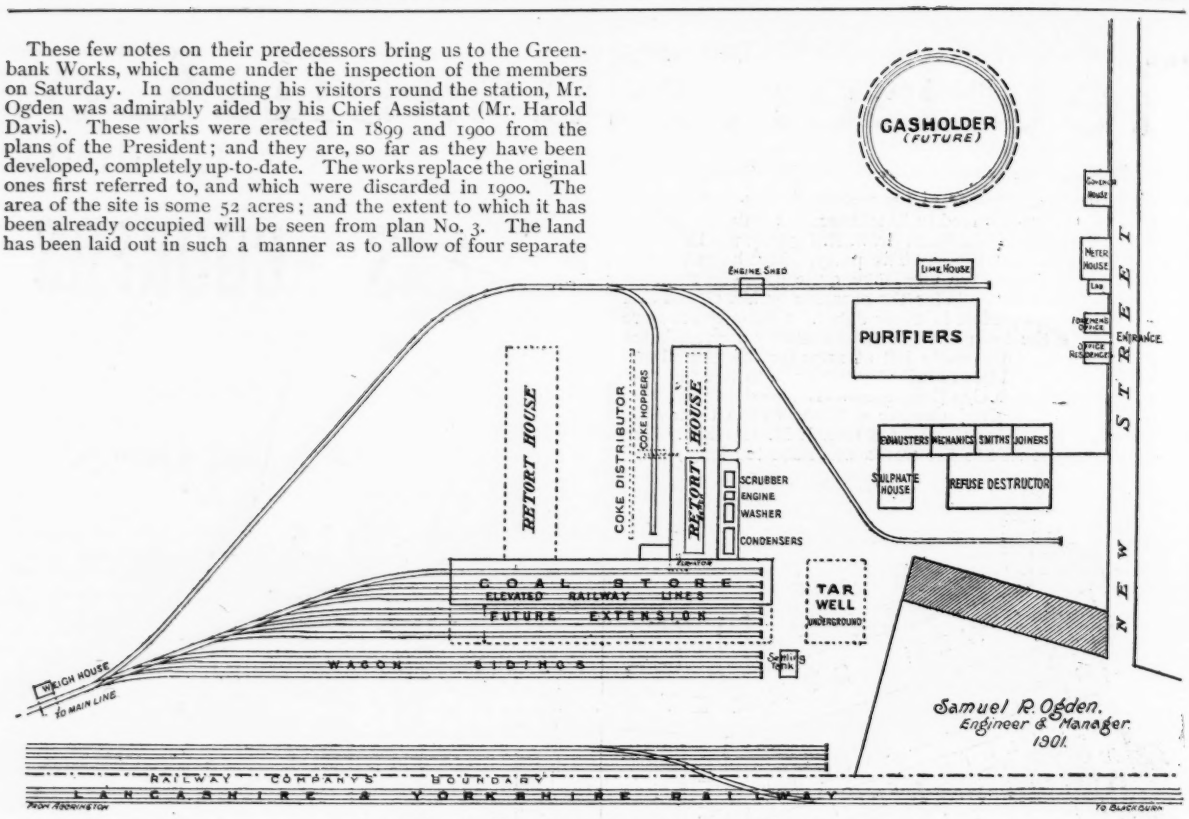

PLAN NO. 2.—NO. 2 GAS-WORKS.

1.—Foreman's house. Offices. 2.—Retort-house. 3.—Carburetted water-gas plant. 4.—Mortar mill shed. 5.—Mechanics' shop. 6.—Cook-house. 7.—Elevated tank and stores. 8.—Blacksmiths' shop. 9.—Joiners' shop. 10.—Exhauster. 11.—Exhausters. 12.—Purifiers. 13.—Oxide of iron shed. 14.—Governors. 15.—Meters. 16.—Gasholder. 17.—Shed. 18.—Laboratory. 20.—Gasholder. 21.—Purifiers. 22.—Wrought-iron liquor tank. 23.—Gasholder. 24.—Stables. 25.—Oil tank.

was the commencement of No. 2 Works in Addison Street, which now cover about 7 acres of ground, and include the largest gasholders. These works were re-modelled entirely in 1876, and have since seen extensive improvements, including regenerative heating of retorts, the addition of carburetted water-gas plant, &c. They are now capable of producing 2½ million cubic feet of coal gas per day, and 1½ millions of carburetted water gas.

Holder No. 16 on plan has a capacity of 545,000 cubic feet; No. 20, 691,000 cubic feet; and No. 23, 3,441,000 cubic feet.

These few notes on their predecessors bring us to the Greenbank Works, which came under the inspection of the members on Saturday. In conducting his visitors round the station, Mr. Ogden was admirably aided by his Chief Assistant (Mr. Harold Davis). These works were erected in 1899 and 1900 from the plans of the President; and they are, so far as they have been developed, completely up-to-date. The works replace the original ones first referred to, and which were discarded in 1900. The area of the site is some 52 acres; and the extent to which it has been already occupied will be seen from plan No. 3. The land has been laid out in such a manner as to allow of four separate




Plan No. 3.—The New Greenbank Gas-Works.

and distinct gas-works being put down as required; each section being capable of producing and purifying 3 million cubic feet of gas per day, with space for the necessary gasholders, and communications from both railway and canal to all sections—thus saving a considerable portion of the cost of cartage of raw material, &c., to and from the goods sidings, such as is incurred in connection with the other works. Altogether there are about 1½ miles of siding. From the works, the gas is conveyed by a special trunk main to the No. 2 works for mixing in the holders, and thence distributing in the town through three Braddock governors—30-inch, 24-inch, and 18-inch respectively.

The first two general views give a good indication of the external character of the works. Fig. 1 is a view looking east; and in the front is seen the purifying-house, with workshops immediately to the left. In the general view of the works looking west, the buildings seen on the left are the sulphate-house, the pump-house, the exhauster-house, the boiler-house, the store-room, and the mechanics and joiners' shops. It is interesting to note that all the water used on the works is obtained from ground drainage, and is collected under the first three-named buildings. Directly behind this block are the refuse destructor buildings and chimney (as seen in the photograph); and the surplus steam generated here is utilized for the purposes of the gas-works. In fig. 3, we have a view of the interior of the retort-house when in an uncompleted state. The house is 241 feet long, 55 feet wide, and 50 feet high (to square); but at present it is only half occupied. It is intended that the house shall contain twenty beds of eight inclined retorts; but at present only ten beds have been constructed. The retorts are tapered from 20 in. by 15 in. to 24 in. by 15 in. in the 20-feet length; and the productive capacity of the bench is about 1,250,000

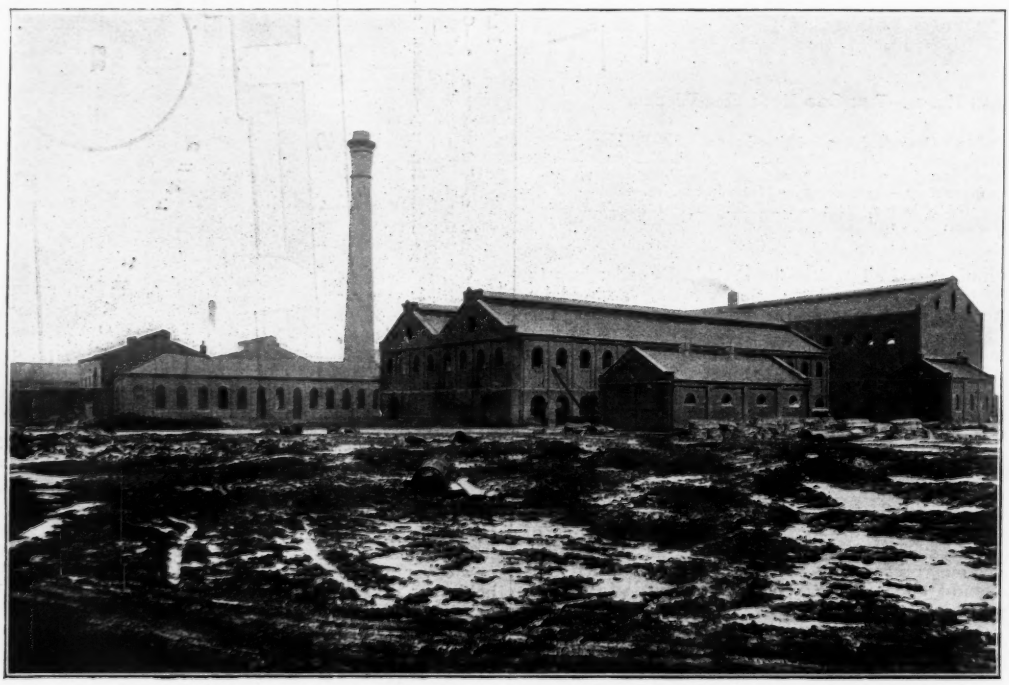


Fig. 1.—General View of the Works—Looking East.

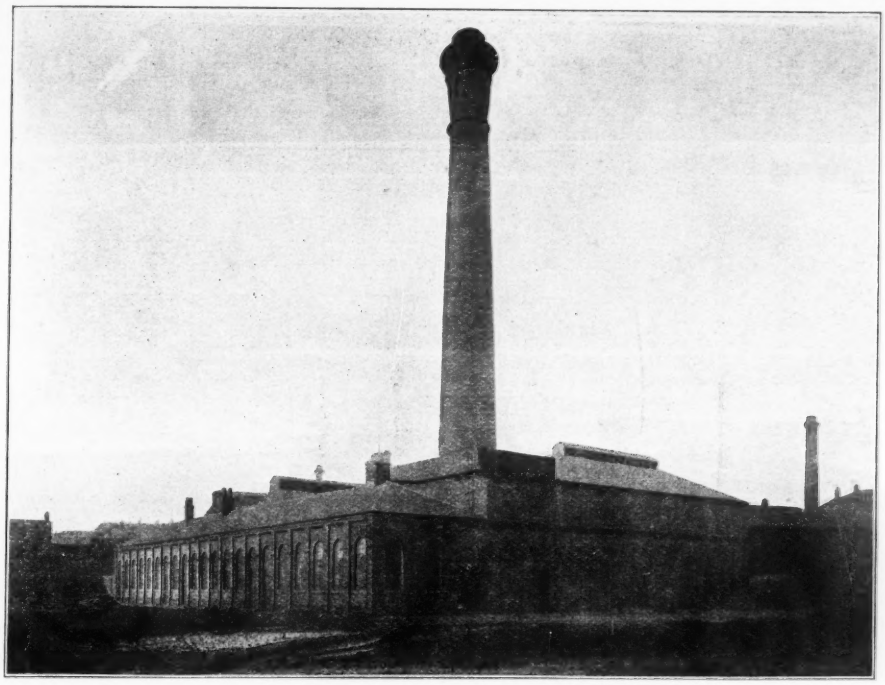


FIG. 2.—GENERAL VIEW OF THE WORKS—LOOKING WEST.

cubic feet, so that, when the second bench is constructed, the house will have a total capacity of 2½ million cubic feet. The installation is a very complete one, and was put in by the New Conveyor Company, Limited, of Smethwick.

The exhauster-house is 45 ft. long by 24 ft. wide, and is intended for three exhausters and engines, each set being equal to 100,000 cubic feet per hour (see fig. 4). The two sets already installed are of Waller's make. The house looks very attractive with its tiled floor and dado and white faced bricks, and is beautifully light. The condensers, washers, and scrubber are in sets capable of dealing with 1½ million cubic feet of gas per day. The purifier-house is a spacious building, as will be seen by the mere mention that it is intended to accommodate eight 35 ft. square by 6 ft. deep twin elevated purifiers. Six have already been constructed. They are on Green's system, and are fitted with bottom discharging doors for the removal of the spent material. Fig. 5 is a general view of the house, showing its principal features of construction, the cover-lifting arrangement, and the belt conveyor and shoot for feeding the boxes. The house is well ventilated, as will be remarked from the photograph. The contractors for the purifiers were Messrs. Ashmore, Benson, Pease, and Co., Limited. The meter-house at present only contains one meter; but there is space in reserve for a second one. That installed has a capacity of 100,000 cubic feet an hour, and it is by Messrs. Braddock, who, as already stated, also supplied the governors. The sulphate plant, which is equal to a production of 4 tons per day, was supplied by Messrs. C. & W. Walker.

We ought not to omit mention of the fact that on the site of the old works in Jubilee Street, there now stands a central office (where the members assembled on arrival) for the convenience of the consumers, a meter-making works, stove show-rooms, &c. The Corporation employ a large number of men making and repairing gas-meters of all sizes for distribution purposes.

### BUSINESS MEETING.

The formal business of the meeting was transacted at the Shireburn Arms Hotel, Hurst Green, where tea was served after the drive to Stonyhurst, and before the return to Blackburn.

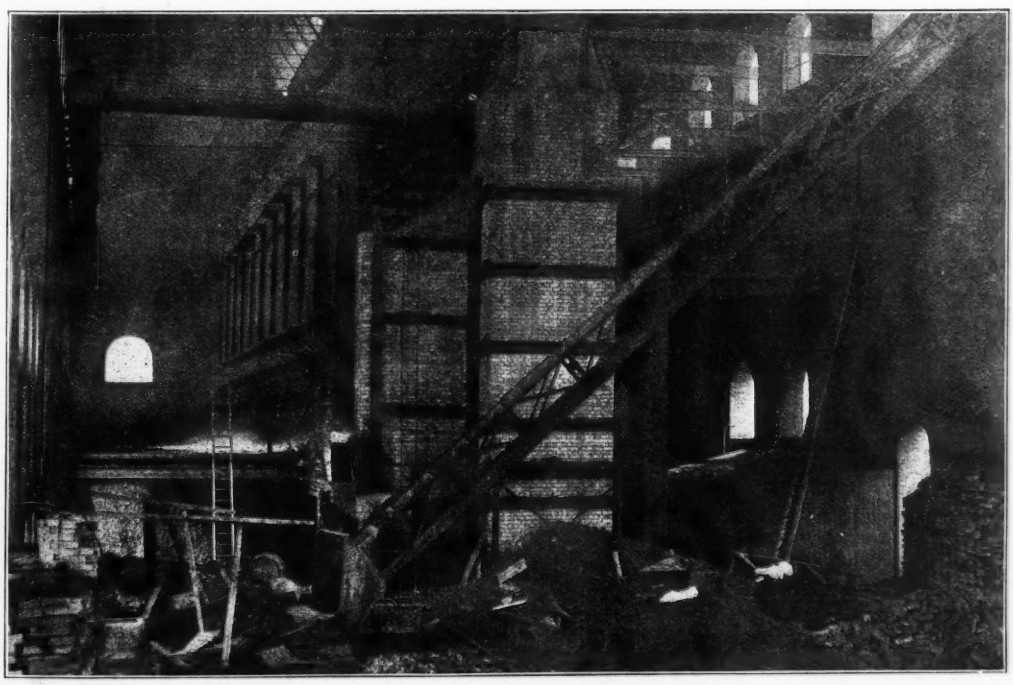


FIG. 3.—INTERIOR OF THE INCLINED RETORT-HOUSE.

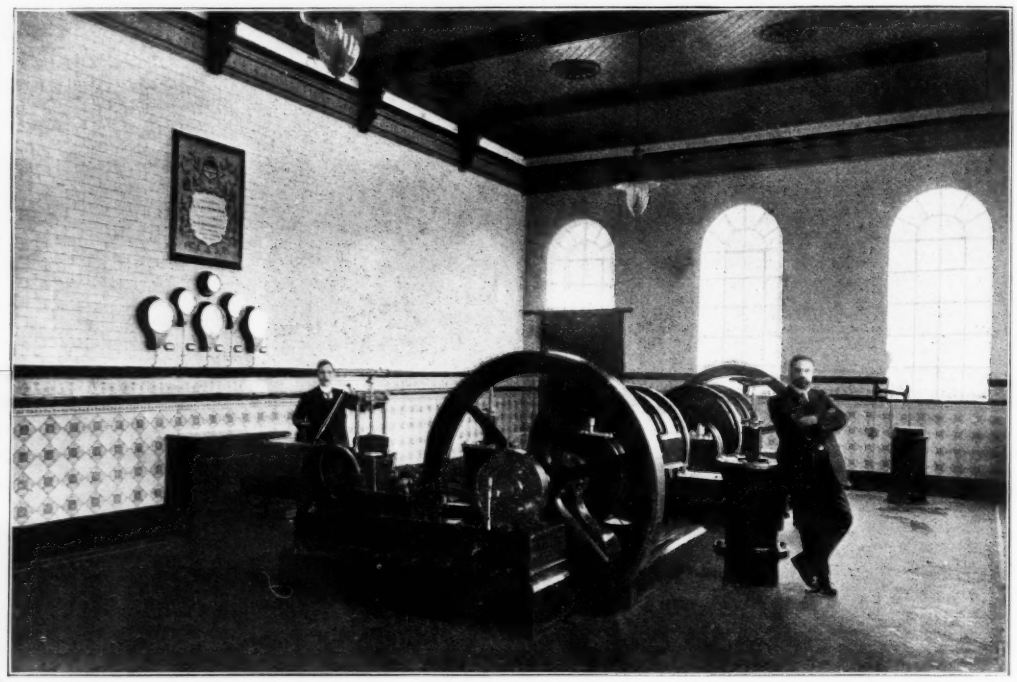


FIG. 4.—EXHAUSTER AND ENGINE HOUSE.

The minutes of the last quarterly meeting were taken as read.

The HON. SECRETARY (Mr. H. Kendrick, of Stretford) announced that he had received letters of apology for non-attendance from a number of members—including Mr. Arthur Graham (who has recently lost his sister), Mr. W. S. Haddock (whose mother is seriously ill), and Messrs. Shadbolt, Wood, Prince, Carr, and Morrison.

The PRESIDENT called upon the Hon. Secretary to read letters from Messrs. Thomas Newbigging and Harrison Veevers, conveying to the members their grateful acknowledgments of the votes of condolence with them in their indisposition passed at the last meeting.

On the motion of Mr. W. W. HUTCHINSON (Barnsley), seconded by Mr. J. BRADDOCK (Radcliffe), a hearty vote of thanks was passed to the hosts for providing the luncheon at the White Bull Hotel, Blackburn.

The PRESIDENT briefly responded, on behalf of his Chairman and the other members of the Committee, who with himself had joined in entertaining the members.

On the proposition of Mr. H. TOWNSEND (Wakefield), seconded by Mr. W. SEVERS (Wilmslow), thanks were accorded to the Sub-Committee who made the arrangements for the day, and the Gas Committee who had so readily thrown open the gas-works to the inspection of the members.

The PRESIDENT responded on behalf of the Sub-Committee, stating that the satisfaction of the members was the best thanks they could receive; and on his own behalf he begged to express his thanks for the assistance he had received from his Assistant (Mr. Davis) and his pupil, and from the Borough Surveyor (Mr. Stubbins), who had kindly explained the working of the refuse destructors to the members. The Gas Committee had done all they could to make the visit pleasant, and would willingly have done more had it been possible.

It was agreed, on the motion of the PRESIDENT, seconded by Mr. C. ELLIOTT (Leyland), that the sympathy of the Association

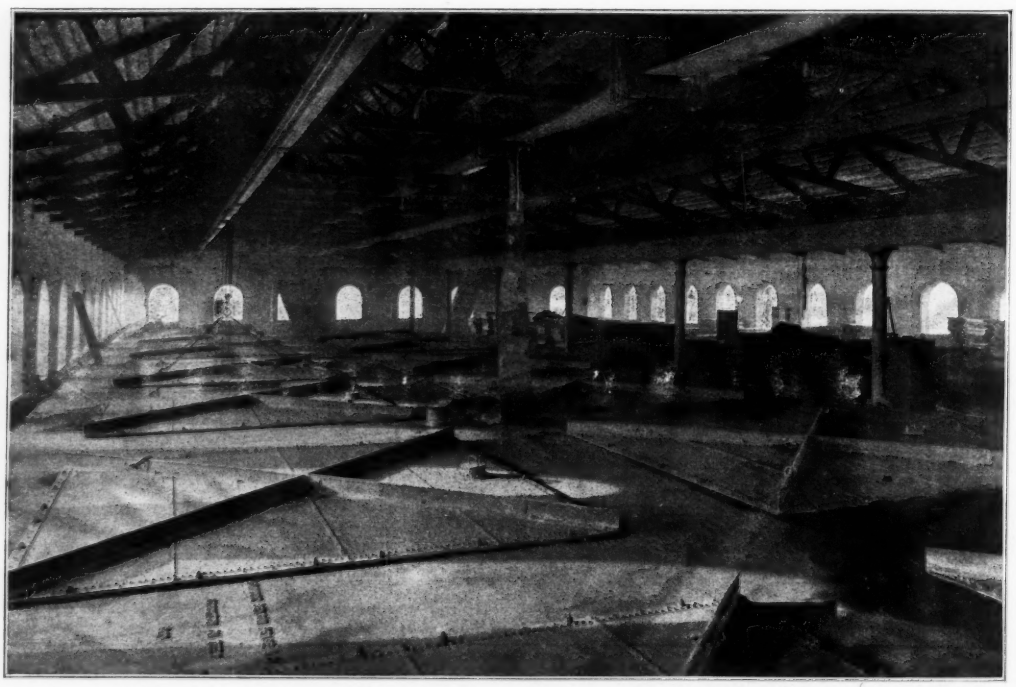


FIG. 5.—VIEW OF THE PURIFYING-HOUSE.

should be offered to Mr. A. Graham in his bereavement and to Mr. W. S. Haddock in his affliction, and that Mr. Isaac Carr be congratulated on his recovery and return to his duties.

The HON. SECRETARY subsequently called the attention of the members to Rule No. 3, relating to nominations of officers and members of the Committee.

This closed the business of the meeting; and after a stroll in the vicinity, the members returned to Blackburn *viâ* Mytton and Whalley.

---

Rule No. 3, referred to above, bears particularly on the nomination of members for the Committee next year; and in order that the matter may not be overlooked, we have been asked to reproduce the section relating specially to the matter, in view of the date mentioned therein (Sept. 30) being now close at hand.

3.—The Committee shall, previous to the November general meeting in each year, prepare a list of members whom they nominate as suitable for the offices of President, Vice-Presidents, Honorary Treasurer, Honorary Secretary, and Auditors for the ensuing year. The list shall also contain the names of three members who have been nominated by the Committee as fitted to become ordinary members of the Committee in place of those retiring by rotation. It shall be open for any member to nominate any other member as a Vice-President or an ordinary member of Committee; the consent in writing of such member having been first obtained. If the nomination be duly made and supported by the names of other two members, and sent to the Secretary, on or before the 30th of September preceding the November general meeting, the Committee shall accept the nomination and include the member so proposed in the voting list. No member shall nominate or support the nomination of more than one member as a member of Committee in the same year.

---

## WAVERLEY ASSOCIATION OF GAS MANAGERS.

### Half-Yearly Meeting at Haddington.

The Waverley Association of Gas Managers held their Eighty-fifth Half-Yearly Meeting in the George Hotel, Haddington, on Thursday last. Mr. P. BLAIR, of Haddington, the President, was in the chair. There was a good attendance of members and friends.

On arrival, the visitors were conducted through the gas-works, which were found to be in a very satisfactory condition, beautifully arranged, and well equipped. A benzol carburettor, put up by Messrs. Milne and Son, Limited, of Edinburgh, has been in use for some time; and at present a set of annular condensers and a tar-extractor are in course of erection by the same firm, which will add greatly to the efficiency of the works. Each of the visitors was presented by Dr. Martine, the Chairman of the Company, with a piece of boghead or Torbanehill mineral (the Company having several tons of this rare commodity in stock) as a memento of the occasion. The samples were labelled, and bore the inscription: "With the Compliments of the Haddington Gaslight Company, Boghead or Torbanehill. Purchased 1850. Tested 1903. Yielded 15,000 cubic feet of 40-candle gas. Peter Blair, Manager." At the hotel light refreshments were on the table. The meeting having been constituted,

Dr. MARTINE, on behalf of his fellow Directors and himself, extended to the Association a very hearty welcome to the ancient and Royal burgh. As they had business on hand, he would not detain them; but he hoped they would have a pleasant meeting, and enjoy themselves thoroughly. Dr. Martine showed the great interest he takes in gas matters by remaining till the close of the meeting.

The PRESIDENT announced the receipt of a telegram from Mr. A. Bell, sen., of Dalkeith, expressing regret that he could not be with them, and the hope that they would have a good meeting.

#### PLACES OF NEXT YEAR'S MEETINGS.

Mr. J. M'LAREN (Duns) moved, and Mr. H. RUTHERFORD (Aberlady) seconded, that the meeting in April next be held in Dunbar, and that in September in Melrose. This was agreed to.

#### INAUGURAL ADDRESS.

The PRESIDENT then read the following address:—

I beg, first, to thank you for the honour you have conferred upon me by electing me your President for the ensuing year.

I may perhaps be permitted to give you a short description of the works under my charge; and I trust that this may prove interesting to you. The coal-store, measuring 70 feet by 35 feet by 15 feet, adjoins the retort-house, and is capable of storing 500 tons of coal. There are four shoots, placed at a higher level than the store, and through each of these some 40 tons of coal can be tipped without handling, so that we can receive 160 tons without any expense for storing. Of course, when more coal is delivered than this, men have to be employed to stack it.

The retort-house (52 feet by 40 feet by 15 feet) contains four ovens of four retorts each, with space for other two ovens. This space is at present occupied by the steam-boiler, which is partly heated by the waste gases before entering the chimney. This is secured by a special damper in the main flue to cause the hot gases to circulate around the boiler. The retort-bench, erected in 1891, cost, from foundation to foul main, £30 per mouthpiece; and each retort has made, on an average, 6 million cubic feet of gas before being renewed. The retorts, sixteen in number, of Ω-shape, 18 inches by 15 inches by 8 ft. 9 in., are heated by simple generators, and are each capable of producing, with a mixture of splint and caking coal, 8000 cubic feet, and with cannel 10,000 cubic feet of gas, per day. We use a jet of steam in the ashpits; and the furnaces only require cleaning once every forty-eight hours. The floors of the retort-house and coal-store are of concrete faced with granolithic, which we find to be of great advantage, as the coal and coke can be easily shovelled up, and the retort-house kept very tidy. The tar and liquor well, which measures 15 feet by 9 feet by 6 ft. 6 in., is made of concrete, and has a capacity of 5000 gallons.

The foul main goes along the end and one side of the retort-house, and is 80 feet in length, before entering the condensers, which have just been erected. These condensers are of wrought iron, on the annular system, with large central tube, so that the gas is contained within a narrow space, through which it travels slowly, and presents a considerable surface to the cooling effect of the atmosphere. The central tube forms a chimney through which air passes; and it is kept in motion by the heat of the gas. These central tubes can be closed by a kind of damper at the bottom, so that the area of condensing surface can be reduced when necessary. Bye-pass connections are provided; and the arrangement has been designed so that a third condensing tube can be added at small expense when the increasing make renders it necessary. The gas then flows to the exhauster, which is capable of passing 7000 cubic feet per hour, and is of the rotary type, driven by steam. We are also erecting a tar-washer, to remove the last traces of tar from the gas. This is after the type designed by Sir George Livesey, and consists of a cast-iron case with a number of inverted troughs of wrought-iron, with a row of tapered slots on each side under the surface of the liquid. The gas passes into all these troughs, and out through the slots in very finely-divided streams, breaking up the tarry bubbles, and depositing them in the bottom of the case, whence they are carried over a weir, which can be adjusted to any height, to the tar-tank. The washer also removes part of the ammonia, carbonic acid, and sulphuretted hydrogen before the gas is delivered to the Holmes rotary scrubber-washer, with its revolving brushes, which are kept free from tar by the tar-washer. This scrubber is driven by the exhauster engine, as are also the tar and liquor pumps and the air-blower for assisting the revivification of the oxide *in situ*. The blower is a miniature exhauster; and, being driven by the same engine as the gas-exhauster, it varies in speed with it. A meter, with a quadrant cock and scale, indicates the quantity of air used for revivifying, and serves to regulate it.

The purifier-house is 55 feet by 29 feet, and contains four purifiers, each 10 feet by 10 feet by 4 feet, with a dry-faced centre-valve to work in rotation, three on and one off. To overcome the difficulty of disposing of the spent lime, and being desirous of using oxide of iron for purification and still retain one purifier for lime for the carbonic acid, we disconnected one of the purifiers from the centre-valve and put in a bye-pass, so that three purifiers can be worked with oxide, two on and one off, and one with lime. We purchased 7 tons of precipitated oxide, and mixed this with an equal quantity of sawdust; and during the last twelve months we have only had to change eight purifiers containing oxide and four purifiers with lime. This has to be compared with our former practice, when we had to change some twenty-four purifiers with lime during the same period. I anticipate, however, that next season we shall only have to change half as many purifiers as we have done this year. We test our gas for sulphuretted hydrogen and for carbonic acid, and try to keep our supply free from both of these impurities, although with our benzol plant the importance of the removal of the latter impurity is not so great. Up to this point all the connections are 8-inch, and they have been renewed during the last ten years. The station meter for four months of the year is working at its full capacity. It has been in use for some thirty years.

As above mentioned, we have adopted benzol enrichment, with which we are very much pleased, our carburettor being of the simplest form. We inserted a pressure-reducer on the main between the station meter and the holder, so that the whole or any quantity of the make of gas can be enriched. There is also a bye-pass on the outlet of the carburettor, so that the enriched gas can be sent direct to the town without entering the holder. The maximum make of gas has been 69,000 cubic feet per twenty-four hours, and the holder capacity is 38,000 cubic feet.

We have a Foulis governor (underground) at the holder station, which is on the opposite side of the road to the gas-works; and the pressure is regulated by placing weights on our air-bell fixed in the gas-works, the connection between the governor and the air-bell being made with a lead pipe laid across the road.

Being desirous of ascertaining the heating values of gases of different grades, and what the ordinary consumer is likely to get in practice, I have made a few rough tests with gases varying from 15 to 45 candle power, with a bunsen burner. All these tests were made with the same burner; but the supply of air and the size of nipple were regulated so as to get the best results from each quality of gas. The vessel also in which the water was

boiled was the same for each test. I find that to raise 1 gallon of water from 60° to 212° Fahr. requires approximately as follows:—

| Candle Power of Gas. | Cub. Ft. | B.T.U. per C. F. | Heating Value per Candle. | "C" Welsbach Burner Requires per Hour. Cubic Feet. |
|---|---|---|---|---|
| 15 | 5·0 | 304 | 20·3 | 3 |
| 20 | 4·5 | 338 | 16·9 | 2¾ |
| 25 | 4·0 | 380 | 15·2 | 2½ |
| 30 | 3·5 | 460 | 15·3 | 2¼ |
| 35 | 3·0 | 507 | 14·5 | 2 |
| 40 | 2·5 | 608 | 15·2 | 1¾ |
| 45 | 2·3 | 661 | 14·7 | 1½ |

I am aware that the results above stated do not quite agree with the theoretical; but I think they may be taken as indicating very nearly the value which the ordinary consumer gets from the gas used, and they are at least comparative.

The last three tests were made with the original boghead or Torbanehill mineral, a few tons of which have been in the works for over fifty years. This I also tested for quality and quantity, and find it still yields 15,000 cubic feet per ton. I used 10 cwt. in four retorts, with the following results:—

| | Gas Made. Cubic Feet. | Candle Power. |
|---|---|---|
| First hour. . . . . | 3200 | 45 |
| Second ,, . . . . . | 2500 | 40 |
| Third ,, . . . . . | 1500 | 35 |
| Fourth ,, . . . . . | 300 | 35 |

7500 cubic feet of 43·6-candle power.

In addition to testing the gas every hour, the test holder was set to fill in four hours, and after standing two days showed 40 candles. To give you some idea of the very great enriching value of this coal, I may mention that it took two days' working with splint coal only to bring down the gas to the 25 candles at which we try to keep our supply.

In conclusion, I should like to say that, while I fear I have not been able to give you much new information, I trust that by this description I may have made the visit to the gas-works more interesting than it would otherwise have been.

*Discussion.*

Mr. W. B. M'Lusky (Perth) said the address had interested him very much; and he thanked the President for the valuable information he had placed before the members. He thought there would be but one opinion in regard to the address; and that was that it ranked among the best the Association had ever had placed before them. He was in the fortunate position of having seen Mr. Blair's works that morning; and he was bound to say that he was maintaining the very best traditions of the Blair family of gas engineers. The system of control and complete check which Mr. Blair had over every operation was something worth noting and copying. From the time the coal went into the works, until the gas passed the governor-outlet, Mr. Blair was able to check exactly what he had done, and what his costs were —not only for the quantity of gas obtained, but also for the quantity of light produced. At a time when there was such a cry for low-grade gas, it was very refreshing to have such an instance of complete check over the value of the light which was being given to the consumer. He also wished to say, in regard to the retort-settings that, Mr. Blair must be a very modest man indeed, in that he had not before announced the value of his setting, because, on closer examination, it was perfectly evident that he was getting really first-rate results with the lowest possible initial expenditure.

Mr. H. O'Connor (Edinburgh) thought that Mr. Blair had given the members a number of details which should be exceedingly useful, not only to gas managers, but to others who had to use gas. He had stated the results of testing gases of various candle powers for the amount of heat they gave; and the figures he had given would be distinctly useful, because, as gas was now being employed enormously for stoves and also in incandescent burners, its heating value had to be considerably taken into account. Mr. Blair's figures, which were worked out in a practical manner, would therefore be of immense value to a great many people. Mr. M'Lusky had remarked about the retort-settings. He thought that a great part of the good results obtained in the retort-setting was due to the care and watchfulness of those who had charge of the work. Many a retort-setting of that description which, if properly looked after and carefully cleaned and watched, would give good results, would, if not looked after, be absolutely wasteful, and worse than an old-fashioned direct-fired setting. He believed Mr. Blair took a personal interest in watching his settings. It was only a day or two before that he told him of his method of cleaning the flues; and it was a most admirable one. It certainly had a wonderful power of cleaning out the small portion of the flue which was not easily get-at-able, and was consequently filled with dust. Mr. Blair used oxide of iron; and they would notice that he had had a considerable reduction in the number of purifiers he had had to open and change. He was quite aware that in a great many works, especially small ones, the item of changing the purifiers did not appear in the balance-sheet, because purifiers had to be changed by the same men who stoked the retorts and the like; but he thought it would frequently be found that, where there was a reduction in the number of purifiers to be changed in the course of a year, there was a real saving, because, if the arrangement which brought about the reduction were not being used, other men would have to be employed to change the purifiers. Mr. Blair was working with benzol; and, as they had heard, he was satisfied with it. He believed that his cost for coal had, in consequence, been considerably reduced. He did not think, however, that Mr. Blair had gone so far as some people in the matter of the low quality of coal he used, because he had probably been employing a moderately decent coal. This, of course, was a great point, as the resulting coke was useful for firing the settings.

Mr. W. Blair (Helensburgh) thought it might look a little out of place for him to rise in Haddington to pass remarks on Haddington gas affairs, and especially on his brother's works; but his love for the town was an old one. He spent a number of years in Haddington; and he obtained results there which, he believed, could not be secured in any other works in Scotland. Certainly a great many improvements had been made in the gas-works since he left. He was delighted, indeed, to see the practical progress which his brother was making. He could only repeat Mr. M'Lusky's words, that everything was under complete control; and he had never been in a works where this could be effected with so much ease as in Haddington. The retort-setting was a very simple one; he did not know of one which could beat it. He questioned if there was any setting which could produce, for the money, better results than were obtained in Haddington. Originally the ovens contained only three retorts each; and now there were four retorts in each. No doubt they were a little contracted, which might lead to a curtailment of the efficiency of the settings; but to get anything like 8000 cubic feet per mouthpiece for four months in the year—and he knew that they repeatedly turned out from 9000 to 9500 cubic feet—from retorts of this area, was, he thought, very good indeed. Up to 10,000 cubic feet was, however, now obtained.

Mr. J. Gemmell (Melrose) said one or two things in connection with the works were certainly worth keeping in mind, more especially the damper controlling the chimney, which he thought was admirable.

Mr. W. Blair remarked that no regenerative or generative setting could be profitably worked unless they had full control of it, and knew the draught or vacuum they had in connection with their furnaces. Much greater efficiency and economy would be secured thereby.

Mr. J. Tulloch (Loanhead) thought they had rather had a lesson than a paper to discuss from the President. Everyone had learned something in being shown round the works; it was an educational visit.

Mr. J. Richmond (Kilkenny) congratulated Mr. Blair on the practical results he was getting. He seemed to be doing exceptionally well in the matter of purification. The purifiers changed during the year, on a make of 12 or 14 million cubic feet, seemed to be exceedingly small; but he thought the proportion of lime purifiers changed to that of oxide was altogether out of the question. He considered that, working good oxide and lime, as Mr. Blair was doing, with three oxide purifiers and one lime, the proportion should not be so great as two to one. He had excellent facilities for extracting the carbonic acid and ammonia, because, with such a splendid brush-scrubber, using a little caustic liquor now and again, he should reckon that they could eliminate very nearly all the carbonic acid.

The President explained that what Mr. Richmond spoke of would be remedied next year, because, owing to the want of condensing power and their not being able to extract the tar, their purifiers got blocked up.

Mr. Richmond (proceeding) pointed out that the President did not say whether he used lime first or last or intermediate. He had had a good deal of experience with oxide purification. In Ireland, they used natural bog ore, which was undoubtedly better than the precipitated chemical oxide. He had tried the lime first, for the absorption of carbonic acid; and he had tried it last. He found the most beneficial way was to work two oxide purifiers first, a lime next, and then to have a catch-box of oxide for taking up the sulphuretted hydrogen which might pass the others. In this way, they would save a vast amount of lime. The table giving the calorific value per candle power would be exceptionally useful for reference in time to come; but it struck him that the proportion of decrease in the heating power of gas was not quite in proportion to the increase in the illuminating power. Neither was the consumption per hour required with a Welsbach burner. The President did not say whether he gave the figures from the point of view of advocating high-quality gas or otherwise. His own impression was that they could be read either way. But he would be inclined to read them as favouring a lowering of the standard, because with 15-candle gas they required 3 cubic feet per hour with a Welsbach burner, whereas when they doubled the illuminating power of the gas, they only brought down the consumption to 2¼ cubic feet. It was a question whether they could produce gas of 15-candle power sufficiently cheap to make it a saving to use 3 cubic feet per hour instead of 2¼ feet of the higher-grade gas. His own impression was that it could be done. His experience was that, with 30-candle power gas, even with the decrease of the consumption, they had a blackening of the mantles, and a want of durability which they did not experience when using (say) 15-candle gas. Besides this, with 15-candle gas they had a splendid heating flame; and there being no precipitation of carbon, everything was more satisfactory, he believed, both from the consumers' and

the suppliers' point of view. As to retorts, he himself secured exceptionally good results; but it was difficult to make comparisons between one set of retorts and another, because of the varying circumstances and classes of coal. He had seen retorts in Scotland in which they could produce 10,000 cubic feet of gas per mouthpiece; but in Ireland if they got 5000 feet they thought they were very well off. Mr. W. Blair spoke of the usefulness of a draught-gauge upon the chimney; but he thought that, besides this, it was a very good idea to use (say) one of Orset's apparatus for testing the flue gases. It was very easily manipulated; and with it they could take samples of the gases, and could tell whether they were having the proper proportion of oxygen admitted into the secondary air, or the primary air, as the case might be. He was very pleased to see mention made of the Torbanehill mineral, because he had had the pleasure of working some 200 tons of it, and always found it very rich.

Mr. O'Connor pointed out to Mr. Richmond that coal in Scotland contained a much larger proportion of carbonic acid than that usually employed in England. His own experience in London was that carbonic acid might be almost entirely ignored; but with Scotch coal it was very different.

Mr. Richmond explained that the coal he was in the habit of using was Newcastle caking coal, which had a very fair percentage of carbonic acid. He had one of Anderson's brush-scrubbers (which he reckoned was quite a modern appliance), and one of Anderson's tar-washers; and he used a little caustic liquor. He did his best to carry the caustic liquor from the hydraulic main to the scrubber and washer, and he found that there was no carbonic acid at all left.

Mr. A. P. Main (Glasgow) said that, from his own point of view, as a manufacturer of gas apparatus, he must confess that he was extremely interested in the table which Mr. Blair had given. It was a table which, as far as his recollection went, had never before been given, of the varying qualities of gas and the calorific results obtained, and also the results secured with Welsbach mantles. There was no doubt that the question of reducing the illuminating power was in the air; and the table would be specially interesting to Scotch gas managers. If they took the two items which would most affect them—the 15 and the 25 candle gas—those were some very interesting facts. He found, for instance, that comparing the 25-candle gas with the 15, according to Mr. Blair's table, to obtain the same value in heating water, 25 per cent. more gas must be used. This was a very striking fact; and it should, perhaps, make some of them pause. It certainly would afford food for reflection. Taking the same qualities of gas—15 and 25 candle—he found that with Welsbach mantles, to obtain, he presumed, the same results, they required 20 per cent more gas. Though the question of light was not particularly within his province, he would like to recall to the minds of the members that the results Mr. Blair had obtained with regard to Welsbach mantles seemed at variance with those obtained by Mr. Webber, when investigating the subject and giving the results of tests made in Germany. Unless his recollection failed him, Mr. Webber stated that in one of the towns in northern Germany the gas had been reduced in quality without the cognizance of the inhabitants of the town; and he understood that about 90 per cent. of the lighting of this town was by incandescent mantles. The surprising thing was that, as the illuminating power of the gas was reduced, they secured superior results from the mantles. He did not quite understand what Mr. Blair meant by gas of 15-candle power taking 3 cubic feet and 25-candle gas taking $2\frac{1}{2}$ cubic feet.

The President explained that it was the lighting value from a "C" burner. It was not a scientific test, but one which anyone could make for himself.

Mr. Main said his impression was that the table would cause a great deal of discussion. He had no personal knowledge of the matter; but he had seen statements made that the lowering of the illuminating power was rather beneficial than otherwise to the incandescent mantle. It was interesting to find that Mr. Blair had got different results. From this point of view, he (Mr. Main) thought the address was exceedingly suggestive.

Mr. M'Lusky remarked that Mr. Main had drawn their attention to the table given by the President, and to the difference between the results he obtained and those secured elsewhere. But he thought that if the President would answer a question with regard to the matter, it would set their minds at rest. The question was whether the gas was enriched with cannel coal alone or with benzol.

The President replied that all the tests were made with pure gas—cannel gas for the higher qualities, and the lower qualities with splint.

Mr. M'Lusky said he had been hoping that the difference in candle power was largely due to benzol enrichment. Of course, they knew it was very much like water-gas enrichment. If they took a gas-fire or a gas-cooker, benzol was a very convenient form of enrichment, in this respect—that either for mantle heating or gas-fire fuel heating, the benzol added had really very little effect upon the heating value of the gas. To give them an illustration, if they took (say) a 16-candle gas, and burned it in a gas-fire, and then enriched the gas with benzol to 20 candles and burned it in a gas-fire, taking into account the volume of gas consumed in each case, they would find that the 16-candle gas was, for all practical purposes, equal to the same gas enriched to 20 candles with benzol. The same thing happened with water gas. If 20 per cent. was added to the illuminating power of the gas, it was a gain with flat-flame lighting, but it was not a gain in calorific value. For mantle lighting, it was acknowledged that it was not so much the illuminating power of the gas in the photometer as its constitution that mattered. He did not recollect whether the experiments referred to by Mr. Main were those which he had in his mind; but gentlemen present would remember that the most important test of all in this regard was the test of a gas which had been enriched and then denuded of its illuminating constituents. The result was taken to prove that the heating power really depended on the proportion of hydrogen in the gas. If they took a dry splint, hammer broken, and charged into a slow retort and drew in three hours, and if they subsequently took a mixture of what was commonly called dross and splint, and put it into a retort and waited till all the gas came off (probably four or four-and-a-half hours) and enriched it up to what the other gas was, though the gases were of the same candle power when drawn, the latter would not be of the same calorific value as the charge which was drawn at the proper time.

Mr. O'Connor said it was a well-known fact that the calorific value of a high-grade gas was not equal to its illuminating value. This had been known for years past; and the tests on which the knowledge was founded had been made with elaborate apparatus for the testing of the fullest heating value that was possible to be obtained from the gas. The tests of the President were made in a more practical and everyday fashion. They were merely made by boiling a certain quantity of water in a certain vessel; and this would very likely account for some difference between the theoretical value which they had in a number of tables made by a great many experimenters. It must be kept in mind also that the President's tests were made with coal gas—not with gas enriched or denuded, but with coal gas alone. There were very few people at the present time who could do this, because they had not the Torbanehill mineral to enable them to make the rich gas. He thought the tests referred to by Mr. Main were made in a town where the comparisons were not suitable for the rich gas they had there.

Mr. Tulloch said he quite agreed with the remarks of Mr. Main. They had had a long experience with Welsbach lighting; and they had found that very rich gas would not do with it, but that they secured better results with a lower-quality gas. The Kern burner was invented to regulate the pressure of the gas; and though it only took $2\frac{1}{2}$ cubic feet per hour, as against 3 or $3\frac{3}{4}$ cubic feet, it could draw in the same quantity of air. With Scotch gas therefore they got a better result from it than from a "C" burner. It was well known that, with a Kern burner, the mantle never got blackened; but with a "C" burner and a rich gas it did. So he thought that a high-quality gas was not suitable for incandescent lighting.

The President said, with regard to the Welsbach burners in the tests he made, with the lower qualities of gas he required to close some of the air-holes, and with the richer gas he had to make the holes bigger. He had one or two different nipples in stock; and he regulated each burner to get the highest result with each quality of gas. He found that, for every 5 candles, he increased or lowered the quantity fully $\frac{1}{4}$ cubic foot, with the same quality of gas. After he changed from the one to the other, the burner would not light—it fired-back—and the result was that he changed the burner. He either closed the air or the supply of gas until he got a burner which burned at its full value; and the same with the nipples for the boiling-rings. It was a question of quantity. Whenever they reduced the illuminating power of the gas, they must use more of it; and they could keep the mantles from getting black by using less gas and more air. In regard to what Mr. Richmond said, he might remark that last winter, owing to the tar getting into the scrubber, it was practically put out of action. It did not extract the carbonic acid; and this was the reason he had been putting in the condensers and the tar-extractor they had seen at the works. He expected that next season, if he changed one or two purifiers, this would be all. He thanked them for the very kind way in which they had received his address.

### Votes of Thanks

Mr. D. Fraser (Gorebridge) moved, and Mr. Richmond seconded, a vote of thanks to the President.

Dr. Martine asked to be permitted to express, on his own behalf, and he knew also on behalf of his fellow Directors, the implicit confidence they had in their Manager, Mr. Blair. They had a high opinion of his predecessor; and he believed that the original Directors of their Company (which had now existed since 1835) had equal confidence in their then Manager, the late Mr. Robb, who was a sort of father to the gas managers of Scotland, at the time of his death a few years ago. They were anxious to help Mr. Blair in any of the new ideas that were coming out, in regard to gas-making; and they were very pleased indeed to instal the benzol apparatus last year.

Mr. R. Hunter (Prestonpans) proposed a vote of thanks to the Secretary of the Association (Mr. W. Young), without whom, he said, they would not get on very well.

---

The members and friends dined together, and afterwards drove to Whittinghame, the residence of the Prime Minister, who had kindly granted permission to the Association to pay the visit. The weather was very wet, and the party did not alight; but the drive through the beautiful grounds, and past the pleasantly-situated residence of the Premier, was quite enjoyed.

# NOTES ON GAS PURIFICATION.

By Dr. H. BUNTE.

The following is an abstract translation of a reprint in the "Journal für Gasbeleuchtung" of the lecture on this subject which Dr. H. Bunte, Professor at the Technical College at Carlsruhe, delivered on June 26, 1902, before the meeting of the German Association of Gas and Water Engineers at Dusseldorf. The lecture was noticed in the "JOURNAL" report of the proceedings of the meeting at the time; but the text of it appears in print for the first time now—fourteen months after its delivery. In committing it to paper, the learned Professor appears to have considerably amplified the original lecture.

Great advances have been made during the past decade in the purification of coal gas, both owing to the development of new processes and because of the more appropriate formation of the apparatus. Stimulated by English progress, German gas engineers have successfully aimed at recovering valuable bye-products, such as ammonia, cyanogen, and naphthalene. It will suffice to mention the names of Bueb, Drehschmidt, Knublauch, and Leybold, to recall the advances which have been made in Germany in this direction. In this communication, the author does not propose to deal with that side of the purification question, but rather to consider the noxious or contaminating constituents of coal gas, which cannot be turned to any lucrative account—such as sulphuretted hydrogen, carbonic acid, oxygen, or air, &c. The point to be specially considered is whether the purification of illuminating gas should still be governed by the same principles as formerly, seeing that a complete change has taken place in the use of coal gas, which is first disillumined in the bunsen burner before it is consumed, whether it is to be applied for lighting or for heating.

When purification merely is spoken of, it is understood to refer to the removal of sulphuretted hydrogen from the crude gas. This removal is effected in Germany almost exclusively with ferric hydroxide, in the form either of the natural brown iron ore, or of artificially prepared material (known as Deicke's purifying material). Purification by means of lime, or material containing lime and ferric oxide (Laming's material), which was customary years ago, has been entirely superseded in Germany; and thus a cause of nuisance from smell has been set aside. There appears to be no reason for departing from the extraordinarily simple and effective process of purification with ferric hydroxide, especially as during the last decade it has been further considerably improved by the addition of oxygen or air to the crude gas, which effects simultaneous revivification of the material in the vessels. This method of adding air was first recommended by Valon and Hunt. It, however, introduces some troublesome occurrences, which may be referred to now, as they have lately been the subject of discussion in the German technical journals. The phenomena of oxide purification may best be explained by reviewing the chemical and thermal changes, which are as follows:—

*Ferric Oxide Purification for the Removal of Sulphuretted Hydrogen.*

FIRST STAGE: PURIFICATION OR FOULING.

(Hydrated Ferric Oxide.) (Sulphuretted Hydrogen.) (Ferrous Sulphide.) (Sulphur.) (Water Vapour.) (Water (Liquid))

$$Fe_2O_3(3H_2O) + 3H_2S = Fe_2S_2 + S + 3H_2O + 3H_2O$$

(193 calories.) ($3\times4{\cdot}8$ cals.) ($2\times24$ cals.) ($3\times58{\cdot}1$ cals.)

$-207{\cdot}4$ cals. $+222{\cdot}3$ cals.

$\therefore 222{\cdot}3 - 207{\cdot}4 = 14{\cdot}9$ calories. (1)

The foregoing indicates that when 3 molecules of sulphuretted hydrogen, or 102·2 grammes, are decomposed, 14·9 calories are liberated. But 1 cubic metre of sulphuretted hydrogen weighs 1520 grammes; therefore it liberates

$$\frac{14{\cdot}9 \times 1520}{102{\cdot}2} = 222 \text{ calories}$$

(or 1000 cubic feet liberate 6286 calories).

SECOND STAGE: REVIVIFICATION.

(Ferrous Sulphide.) (Sulphur.) (Oxygen.) (Water.) (Hydrated Ferric Oxide.) (Sulphur.)

$$Fe_2S_2 + S + 3O + 3H_2O = Fe_2O_3(3H_2O) + 3S$$

$2\times24 = -48$ cals. $+193$ cals.

$\therefore 193 - 48 = 145$ calories. (2)

Consequently, the revivification of the sulphide of iron resulting from 1 cubic metre of sulphuretted hydrogen develops

$$\frac{145 \times 1520}{102{\cdot}2} = 2160 \text{ calories}$$

(or from 1000 cubic feet, 61,160 calories).

THIRD CASE: SIMULTANEOUS FOULING AND REVIVIFICATION BY ADDITION OF AIR.

Per cubic metre of sulphuretted hydrogen, there is liberated:

According to (1) = 222 calories.
" " (2) = 2160 "
Total 2382 "

(or a total, per 1000 cubic feet, of 67,446 calories).
This result may, of course, be arrived at also directly.

Now, according to the old method, two distinct processes had to be considered—viz.: (1) Fouling or purification, and (2) revivification. In the fouling, the sulphuretted hydrogen in the gas reacted with the ferric hydroxide, and there were formed sulphide of iron and water, and some sulphur was liberated. The heat liberated amounted to 222 calories per cubic metre (or 6286 calories per 1000 cubic feet) of sulphuretted hydrogen. But as the latter was greatly diluted by the other constituents of the crude coal gas, this development of heat was scarcely noticed. For instance, assuming 1 cubic metre of coal gas has a specific capacity for heat of 0·362, and that the crude gas contained 1 per cent. of sulphuretted hydrogen, then the rise in temperature of the gas due to the heat liberated in fouling would be $\frac{222}{36{\cdot}2} = 6{\cdot}1°$ C. The heat liberated, however, is not wholly taken up by the gas, but is partly communicated to the purifying material and the walls of the vessel. The rise of temperature thus becomes so small as to escape direct observation. Consequently, "fouling" in itself is attended with only a comparatively small evolution of heat.

But it is otherwise with the revivification of the material, when, as shown under (2), the heat liberated is nearly ten times as much as in the fouling. The great development of heat during revivification is indeed a matter of common observation, as it causes so considerable a rise in temperature that incandescence and ignition of the material may easily ensue. One kilogramme of sulphide of iron develops by its oxidation to ferric oxide 824 calories (or 1 lb. develops 374 calories). Fortunately, however, the revivification usually takes place gradually, as only a small portion of the material consists of sulphide of iron, and the heat has thus time to be dispersed. But, in particular, a certain amount of moisture in the purifying material is unfavourable to too high a rise of temperature, as the moisture is thereby vaporized.

On the other hand, too, it is necessary that water should be present during the revivification of sulphide of iron, in order that the conversion may be to the hydroxide and not to the anhydrous oxide of iron. Special care must therefore be taken that, while the material for revivification is not too wet, it shall not on the other hand be too dry. A moderate rise of temperature is requisite for thorough revivification; but too great a rise brings with it other disadvantages in addition to those mentioned—such as the decomposition of cyanides and their conversion into sulphocyanides, whereby the value of the spent material is diminished. The last point has been constantly referred to in discussions on the cyanogen question, and need not now be pursued.

The same thermal exchanges occur under the newer plan of purification with addition of air or oxygen to the crude gas; but there is the distinction that the chemical changes which, under the old plan took place at separate times and places, now proceed simultaneously alongside one another. Obviously the development of heat in the purifiers will rise with the addition of air to the gas to about ten times what it otherwise would be; and therefore it can no longer be disregarded. If the whole of the heat liberated by fouling and revivification were transferred to the gas, then, if the latter contained 1 per cent. by volume of sulphuretted hydrogen, it would undergo a rise in temperature of from 65° to 66° C. (say, 118° Fahr.) compared with a rise of 6° C. (say, 11° Fahr.) if no air were admitted to the purifiers. Obviously this calculated rise is never attained, because a great part of the liberated heat is expended in heating up the solid material and the vessel, and is dissipated by conduction and radiation. In order to ascertain the conditions actually prevailing in practice, Dr. Becker (one of the author's pupils) has made experiments at the works of the Frankfort Gas Company. He has found that, with fresh oxide of iron, rises in temperature of as much as 30° C. (54° Fahr.) occur in the purifiers.

Such a great increase in temperature is attended by a very vigorous evaporation of moisture, which dries up the material, and may very greatly affect its activity. Assuming that the well-cooled crude gas enters the purifying vessel at a temperature of 10° C. (50° Fahr.), and is saturated with aqueous vapour, then 1 cubic metre of the gas contains about 10 grammes of water vapour (or 1000 cubic feet contain 10 oz.). If the temperature is raised by 20° C.—*i.e.*, to 30° C. (86° Fahr.)—the gas may take up a further 20 grammes of water vapour per cubic metre (or 20 oz. per 1000 cubic feet) before it reaches saturation point. It will thus remove a great quantity of water from the oxide, which was moist to start with, and the material will become dry and dusty and lose its activity. When there is no longer moisture present, heat is not consumed in evaporating the water. The temperature, consequently, rises still further; and the very finely divided and readily fusible sulphur in the oxide may then cake it together and cause obstructions such as are frequently observed in practice. The fact that large quantities of moisture are actually removed from the oxide when continuous revivification is practised is substantiated by the condensation of large quantities of water in the lower part of the purifier or in the next vessel. A portion of the water taken up from the oxide is condensed as soon as the gas comes in contact with the colder surfaces of the next vessel, &c.

*(To be continued.)*

**Monazite Sand.**—The exports of monazite sand from Bahia in 1902, according to the "Iron and Coal Trades Review," were valued at £17,714 (52 per cent.) less than in 1901.

## THE EXETER EXPERIMENTS WITH THE SETTLE-PADFIELD PROCESS.

As everything may be considered of interest just now in the way of results obtained from the carbonization of coal in one or other of the systems of vertical retorts recently described in the "JOURNAL," we reproduce from the "American Gaslight Journal" of the 31st ult., some remarks by Mr. Norton H. Humphrys on the Settle-Padfield process.

I have lately been engaged in some experiments with a new method of carbonizing coal, which offers promise of a substantial improvement, both in yield of gas and of coke, upon ordinary working, and also the prospect of utilizing any and every kind of coal that is capable of yielding gas—including cheap small and slack of a kind that cannot be satisfactorily dealt with by ordinary methods. The process has been protected by patent granted to Messrs. Settle and Padfield, of Exeter; and the special feature is the use of vertical retorts, which are charged by means of a mechanical air-locking device with small quantities of coal (say) 2 lbs. to 7 lbs. at a time. The effect of introducing the coal piece-meal, instead of dumping it in at one operation, is to introduce an entirely new set of carbonizing conditions. Instead of having a rapid production of high-quality gas to begin with, gradually tailing off both in quantity and quality as the operation proceeds—giving such an inferior quality at the finish that with some kinds of coal it is the wisest policy to stop the distillation some little time before the gas is all driven off, and let the last few hundred cubic feet go to waste—there is a rapid and steady evolution of an even quality of gas. The results, put shortly, as compared with ordinary methods, are an increased yield of gas to the extent of 25 per cent. or more, and a slightly less increase in respect to actual sperm value. Over 6 cubic feet of gas per pound of coal can be obtained, and the coke is harder and increased to the extent of $\frac{1}{2}$ cwt. to 1 cwt. per ton of coal, while tar becomes a negligible quantity altogether. If preferred, about half the usual quantity of tar can be obtained, or every bit of it can be converted into gas and coke.

The experiments have extended to many different kinds of coal, and exceed 100 in number. They have been conducted with one retort only so far, capable of dealing with 2 to 3 cwt. of coal per charge; but it is intended to work on a larger scale as soon as the plant can be put down, so as to get a fair test of actual working costs, capital expenditure, and so on.

As an example of the somewhat hackneyed observation that history repeats itself, attention may be directed to the fact that the vertical retort—one of the first forms of retort used by Murdoch—is again coming to the front. Other inventors besides Messrs. Settle and Padfield appear to have had their attention directed to the advantages afforded by this form of retort. The idea of letting the coal tumble in at the top, and the coke tumble out at the bottom—a simple and cheap process in each case—has always proved attractive in theory. But no one has yet put it into satisfactory operation on a large scale and in a manner that gives a satisfactory yield of gas and also of coke.

The best results as regards gas, with the Settle-Padfield process, are obtained by feeding in very small quantities (say) 2-lb. charges or so; but the coke is so bulky, light, and friable as to be worthless as a commercial article. Where coal (and consequently coke) is cheap, this might prove the better way of working, as a yield of 7 to 8 cubic feet of gas per pound of coal is obtained. But in most cases a good yield of hard coke is also required. To obtain this, larger charges (say, 4 to 7 lbs.) must be used; and the results above recorded were obtained under such conditions. With a slightly reduced yield of gas—but still 25 per cent. more than is usually obtained—there is also a large yield of hard coke suitable, so far as physical qualities are concerned, for foundry or cupola use, or for water-gas generators.

The process might be used in conjunction with water-gas; the Settle-Padfield retort being fixed on the charging-floor at such a level as to admit of the generators being charged with hot coke.

This new method of working opens up a lot of possibilities; and there is undoubtedly a future before it. The exact lines on which it will be worked, however, will require development by experience on a large scale. Among other investigations, exhaustive tests are to be made as regards the questions of calorific value and of naphthalene.

## CALCIUM CYANAMIDE: THE NEW NITROGENOUS FERTILIZER, AND SOURCE OF CYANIDES.

At the International Congress of Applied Chemistry held at Berlin in June last, a paper was read by Dr. Erlwein (of the firm of Siemens and Halske), on calcium cyanamide as a new starting material for the production of cyanides of the alkalies.

The nitrogen in the cyanides is by this means derived from the nitrogen of the air; the calcium cyanamide is produced technically from carbide or carbide forming mixtures. The inception of the present cyanide method is due to the work of Dr. Frank and Dr. Caro, which showed that when nitrogen acted on the heated, powdered carbides of the metals of the alkaline earths—especially barium—carbon was deposited, and cyanamides were formed. The latter, on fusion with soda or other flux, could be converted into cyanides of the alkalies. Pfleger made an advance when he succeeded in replacing barium carbide by calcium carbide, the manufacture of which is considerably simpler. With calcium carbide, it appeared that the absorption of nitrogen, with deposition of carbon, according to the equation $CaC_2 + N_2 = CaCN_2 + C$, results only in the cyanamide being produced. In accordance with the numerous chemical and physical differences between the barium and calcium cyanamides, it was found that for the fusion for the production of cyanide, it was not necessary to use soda with the calcium as with the barium salt, but that common salt (sodium chloride) could be used instead. The product thus obtained by fusion is dissolved and treated with mineral acid. The hydrocyanic acid evolved is collected in receivers containing alkali as an absorption agent, and on evaporation the alkaline cyanide is obtained as a commercial product.

It is an interesting and important fact that in agriculture calcium cyanamide has also proved very effective as a fertilizer for plants, because it gives up its nitrogen to the soil in a form in which it is easily assimulated. This use of the salt has been dealt with more fully by Dr. Frank in a paper of which an abstract is given in the next article. The difficulty of producing calcium cyanamide by means of a new direct process in the electrical resistance furnace, from mixtures of lime and coal, according to the equation: $CaO + 2C + 2N = CaCN_2 + CO$, has been also successfully overcome; and this renders its production cheaper than when it is made from carbide.

It was also found that the amide of the cyanamide compounds, whether obtained by nitrification of ordinary carbide or from lime and coal by the direct process in the resistance furnace, could be isolated in the form of crystalline dicyanodiamide by a technically simple leaching process. The solid white dicyanodiamide—in appearance resembling sal ammoniac—has been useful as a starting material for a new technical potassium cyanide process, which, by simple methods of fusion, yields white 100 per cent. commercial potassium or sodium cyanide.

In this fusion process, a considerable proportion of the nitrogen is converted into cyanide, while there are also formed volatile ammonia, and, as sublimation products, a mixture of cyanamides—among which is melamine (tricyanotriamide), which is returned for refusion, and is thus partly converted into cyanide.

The reactions, which occur in the dicyanodiamide process, starting with the black cyanide mass coming from the furnace, may be approximately represented by the following equations:—

(*a*) In the leaching:—

$$2CaCN_2 + 4H_2O = 2Ca(OH)_2 + (CN.NH_2)_2$$

(*b*) In the fusion, by which several reactions take place successively, for example:—

$$(CN.NH_2)_2 + Na_2CO_3 + 2C = 2NaCN + NH_3 + H + 3CO + N$$

The potassium cyanide or sodium cyanide arising in the fusion process, is, as already mentioned, a perfectly pure, white, crystalline product, which, without requiring any further purification, is equal in value to the best trade brands.

In the course of the experimental work on the conversion of calcium cyanamide nitrogen into cyanide nitrogen by fusion with common salt, a product was obtained with a value of 30 per cent. of potassium cyanide; and this has proved to be very useful for cyanide gold washing. It should—especially when manufactured in the gold mining countries themselves—be, on account of its cheapness, capable of very extended application.

## UTILIZATION OF ATMOSPHERIC NITROGEN FOR AGRICULTURAL AND INDUSTRIAL PURPOSES.

The following is an interesting account of the latest development of the problem of the practical fixation of atmospheric nitrogen on a manufacturing scale. It is taken from a paper read by Dr. Adolph Frank, of Charlottenburg, before the International Congress of Applied Chemistry in June last.

The consumption of nitrate of soda for technical and agricultural purposes is increasing year by year, so that the time is not far distant when the world's store of nitrate will be exhausted. The exports from Chili amounted in the year 1860 to 68,500 tons, and in 1900 to 1,453,000 tons. The most careful investigations have shown that the store of nitrate will be exhausted in from 20 to 40 years' time. Endeavours have therefore been made for a long time to convert the atmospheric nitrogen into ammonia or cyanide. Germany imports yearly about 500,000 tons of nitrate, which, with a percentage of 15·8 of nitrogen, corresponds to a supply of about 79,000 tons of nitrogen. This is about the amount of nitrogen present in the column of air, weighing 100,000 tons, which rests upon 1 hectare (2·47 acres) of the earth's surface. The raw material for the production of nitrogen compounds is therefore always at hand; but the extremely inert nature of the atmospheric nitrogen, offers the greatest obstacle to attempts at combining it chemically. The author then proceeds to touch on earlier attempts to utilize the nitrogen of the air, and states that the production of carbide by the aid of electrical energy

accomplished in the year 1894 by Moissan and Willson, indicated a new direction for the earlier attempts of Marguerite, Sourdeval, and Mond at obtaining the nitrogen of the air in the form of cyanide and ammonia. This latter direction was pursued by the author directly the new methods of electrical carbide production had been made known, although Moissan's experiments to effect the absorption of nitrogen by carbide had at first given negative results. In conjunction with Dr. Caro, the author determined the conditions under which the combination of the nitrogen with carbides of the alkalis and earth alkalis, especially barium carbide and calcium carbide, takes place, and for the purpose of carrying out these experiments on a large scale, he put himself into communication with the firm of Siemens and Halske. This led up to the formation of the Cyanide Company (Cyanidgesellschaft), an independent undertaking devoted to the further prosecution of the matter.

At the outset of his work, the author had specially in view the production of cyanides, as being the more valuable combination of nitrogen. For this object barium carbide appeared particularly suitable because it fixed the nitrogen directly, according to the equation $BaC_2 + 2N = Ba(CN)_2$. The barium cyanide so obtained could be worked up into potassium ferrocyanide and alkaline cyanides by simple methods. The behaviour of calcium carbide towards nitrogen appeared less favourable, as, in spite of the apparently stronger absorption, the formation of only a very small quantity of cyanide could be detected. Further examination of the product of the reaction showed, however, that when nitrogen was taken up by calcium carbide, it was not calcium cyanide that was formed, but calcium cyanamide, one atom of carbon being separated thus—

$$CaC_2 + 2N = CaCN_2 + C$$

The author then found that the whole of the nitrogen of the calcium cyanamide, as well as of the pure cyanamide made from it, could be converted into ammonia by heating with water at high pressure—

$$CaCN_2 + 3H_2O = CaCO_3 + 2NH_3$$
$$CN_2H_2 + 3H_2O = 2(NH_4)CO_3$$

This led to the conclusion that the crude calcium cyanamide obtained also from carbide, or mixtures for forming carbide, by the absorption of nitrogen, could be employed directly as a nitrogenous manure for feeding plants, under suitable conditions. Experiments in this direction with calcium cyanamide, or as the author technically calls it "lime-nitrogen," have been carried out by Professor Wagner at Darmstadt and by Dr. Gerlach at Posen many times, both in plant houses and in the open. They have led to the conclusion that nitrogen applied in the form of calcium cyanamide, is almost equivalent in its effect on various plants to the same quantity of nitrogen, applied in the form of ammonia salts, and is little inferior in effect to the nitrogen of nitrate. According to these experiments the nitrogen of the calcium cyanamide is first transformed in the soil into ammonia, and is then nitrified in the same manner as the latter.

It need hardly be pointed out, that with a body so entirely new in its composition and effect, many experiments will still have to be made to determine the soils most suitable for it, as well as the mode and time of its proper application. The proportion of nitrogen in the calcium cyanamide or "lime nitrogen" varies from 14 to 23 per cent., according to the process employed in producing it. Nitrogenous bodies of the highest concentration are, however, pure cyanamide $CN_2H_2$ and the polymeric dicyanodiamide $C_2N_4H_4$, both of which contain 66 per cent. of nitrogen.

How far these bodies are suited for the purpose of feeding plants is not yet sufficiently determined, although it is known that cyanamide by simply taking up water is transposed into ammonia thus: $CN_2H_2 + H_2O = CH_4N_2O$. But cyanamide and dicyanodiamide, now that it has become possible to obtain them in bulk, are, from their composition and nature, valuable raw materials for building up other complex nitrogenous compounds.

Without, however, looking too far ahead, it may be taken as an accomplished fact that now, with the aid of the electric energy which is at disposal in many places, the hitherto inert nitrogen of the atmosphere can be made serviceable and rendered of use for agricultural and technical purposes. In the course of the discussion, the author stated further that the price of 1 kilo. of nitrogen in the new compound was such that it could compete with sulphate of ammonia and nitrate of soda.

**A 40-Ton Oil-Tank Waggon.**—The question of the conveyance of oil is now one in which a large number of gas undertakings are interested. An engineering contemporary last week described and illustrated a bogie oil-tank waggon, which is believed to be the largest now running in this country. It is one of several that are being built for the Oakbank Oil Company, Limited, at the present time by Messrs. R. Y. Pickering and Co., Limited, of Wishaw. The tank itself is 42 ft. 6 in. long, with a diameter of 6 ft. 7⅛ in., and is carried on a frame constructed of steel channels and angles, seated on two four-wheel bogies of the diamond frame type. The outlet is 4 inches in diameter, with a cock to control the running off of the liquid. The wheel-base of the bogies is 5 ft. 6 in., and the distance from centre to centre of the bogies is 32 feet. The tare of the vehicle is 19 tons 17 cwt.

# THE GEOLOGY AND UNDERGROUND WATER SUPPLY OF SOUTH LINCOLNSHIRE.*

By Henry Preston, F.G.S., of Grantham.

**[Abstract of a Paper read before the British Association of Water-Works Engineers, with a Summary of the Discussion.]**

Recent borings have revealed several points of interest in connection with both the geological structure and the underground water supply of this part of South Lincolnshire; and the purpose of these notes is to bring before the Association certain observations on a few wells and borings which have been made in the district, and to try and discover some relationship between the observed results as regards water supply and their geological causes.

The author proposes to deal with the following points: (*a*) The general geology of the district, with special reference to such water-bearing rocks as occur at the surface. (*b*) Rainfall, percolation, and geological structures regulating underground water supply. (*c*) Special examples of borings and their results. (*d*) Probabilities of quantity and quality deduced from recent observations.

In geological structure, the county of Lincolnshire offers a most interesting field for study. Nearly the whole of the formations which come between the Keuper Marls of the Triassic system and the Upper Chalk of the Cretaceous system can be studied. The lowest beds cropping out at the surface are the Lower Lias; and the author is acquainted with only one boring within the prescribed area, sunk in 1874 by Messrs. Hornsby, at Grantham, which has penetrated beyond the Rhætic Beds. There are some large outliers and bold escarpments of Marlstone on the west; and these yield very good water, both from wells and springs. The springs, however, fluctuate very much with the seasons; and the wells yield a limited supply owing to the gathering area being small. The difference in quality between the water from deep borings in the parent rock and that obtained from wells and springs in outliers, indicates a very sluggish flow of underground water in the Marlstone of this district; hence we get a high percentage of soluble substances in the water.

Nor does there seem to be a satisfactory continuance of the strata eastwards. Near Grantham the Marlstone is 30 feet thick; whereas a boring at Stamford, made in 1899, penetrated 255 feet below the Northampton sands, and the only representatives of the Marlstone were two bands of rock, 1 foot and 4 feet thick respectively, with 4 ft. 6 in. of clay between them. Thus there is evidence of a thinning out of Marlstone eastwards. As will be seen, however, when we come to consider the Crowland boring, there is evidence of a redevelopment of these strata to a considerable thickness; but without any useful addition to the yield of water. The Northampton sands vary very much in character, and consist of beautiful white quartzose sand, sandy clay, clay, limestone, or ironstone, according to the locality in which they are studied. It is, however, to the massive limestones overlying these beds that we must look for an abundance of water.

The following records of rainfall taken at seven stations will give a fair average for the whole district.

*Table of Rainfall.*

| Station. | Period of Observation. | | Highest. | Lowest. | Average. |
|---|---|---|---|---|---|
| Grantham . . . | 21 years. | 1882–1902 | 34·67 | 17·01 | 23·27 |
| Holywell . . . | 7 ,, | 1896–1902 | 26·67 | 21·45 | 23·46 |
| Stamford . . . | 13 ,, | 1882–1894 | 32·19 | 16·37 | 24·54 |
| Market Deeping . | 12 ,, | 1891–1902 | 23·23 | 14·73 | 19·52 |
| Spalding. . . . | 21 ,, | 1882–1902 | 30·88 | 15·13 | 23·16 |
| Boston . . . . | 21 ,, | 1882–1902 | 31·76 | 12·94 | 21·59 |
| Long Sutton . . | 18 ,, | 1882–1899 | 31·69 | 17·84 | 23·48 |

The average rainfall for Boston for the 60 years, 1830-99, was 23·49 inches.

Next to the rainfall, the relative porosity of the strata on which the rain falls and the problem of percolation must be considered. In following up the subject thoroughly in the case of any given area or any geological formation, many things have to be taken into account. Thus, observations must be made on the nature of the soil and subsoil, as these are necessarily feeders of the rock formations below; and the effect of the water upon the fissures or capillary spaces, as well as the variable conditions of the surface rocks due to changes of climatic conditions, all require careful study. For example, the percolation in the case of the Lincolnshire Boulder Clays cannot much exceed an inch or two a year; yet there are exceptions to this in cases where, after a period of drought, the clay cracks considerably—the fissures extending to a depth of several feet, and forming channels into which the first fall of rain is rapidly absorbed, or through which it passes to pervious strata below.

The characteristic tendency of all the Limestone beds, particularly Lincolnshire Limestone, is to weather into small fragments,

* This paper, with the appendices, covered 24 printed pages; and we have to thank the author for abstracting its principal features for publication in the "Journal."—Ed. J.G.L.

which are found in layers which form a subsoil of fragmentary rocks, 10 feet or more thick, into which water percolates very readily, and thence travels freely through the fissured rock beneath. These considerations, together with general observations of the action of water in cracks, fissures, and swallow-holes on the exposed surface of the Limestones, indicate that, out of an average of 23 inches of rain, we may reckon on getting 10 inches of percolation into the Lincolnshire Limestone rock. More extended experiments, or more careful observation and calculation, may possibly modify this estimate; but the author does not think the results would reduce the proportion above quoted.

This being essentially a Limestone district (as far as its underground water is concerned), it must not be forgotten that the interstices of the rock as well as the fissures are acted upon by the water flowing through them. Moreover, this action is by no means always similar in its effect. Where rain water, carrying with it various acids from the air and from surface vegetation, enters the Limestone, a very marked solvent action takes place, which has the effect of widening the fissures and capillary spaces. The extent of this action can be measured approximately from the "hardness" acquired by the water in its passage through the rocks. If, however, this hardened water, instead of finding an outlet at the surface, continues to travel slowly through the rock to greater depths, it may come in contact with soluble substances which will react upon it, and precipitate the lime in solution; and this may tend to fill up the fissures and seriously reduce the porosity of the rock.

As every well-section gives some additional information of the hydro-geology of a district, so it is of the greatest importance that the strata and results of such well or boring should be recorded intelligently and systematically. For want of this, much valuable information has been lost even in this limited area; and, considering the fact that no boring can be undertaken with any confidence as to the result without the most careful study of the geological conditions of the particular district, this is especially to be regretted.

It is often said that the best position for sinking a well in a pervious rock is just where the rock enters beneath an impervious stratum. Springs are common where the Lincolnshire Limestone passes under the clay beds forming the Fens; and this is an indication that the rock is full of water. The probabilities are that the full thickness of the rock will be encountered at this point, and a good storage obtained. At a greater distance from the outcrop—*i.e.*, where the water-bearing rock is overlaid by other strata—it may be, and often is the case, that a more abundant supply can be obtained, and that under a greater hydrostatic head; but in this case certain risks have to be run. For example, if the underground water has no natural flow, as will be the case if it cannot find an outlet in the form of springs, the fact of its being retained for a long period in the deep-seated bed will probably cause it to dissolve a large percentage of solids, and when tapped it may prove faulty in quality, whatever the quantity may be.

Bourne, in South Lincolnshire, is a noted centre for artesian wells; and some extraordinary flows are obtained from borings in the locality. One which was put down by Messrs. Isler and Co. in 1893 is well known. A yield of over 5 million gallons per day was obtained from a depth of 134 feet through a 13-inch tube. This was made for the Spalding water supply, and is supposed to be the largest yield from any boring in the country. The constant pressure at the surface was 10 lbs. per square inch. As an index to the great quantity of water in the rocks underlying Bourne and district, the author may mention the "Well Head," a natural blow-well or spring, which, supplying the "Bourne Eau," forms the chief tributary of the River Glen. In 1874, this spring was gauged, and yielded 4,600,000 gallons per day. Besides this and the large boring for Spalding, there are numerous smaller borings yielding abundant supplies from depths varying from 90 to 130 feet; the water often rising 30 or 40 feet above the surface, and supplying the upper storeys of houses by natural pressure alone. This pressure, however, sometimes fluctuates; and the author has known a case where the pressure failed to the extent of 25 feet head.

The most recent boring in the district is the one at Crowland, which has penetrated the Lincolnshire Limestone at the most easterly point in the county. This was only recently carried out (under the supervision of Messrs. Hodson and Son, of Loughborough) for the Crowland Rural District Council, but has been abandoned as a water supply for the town, in consequence of the small yield of water obtained and the large percentage of solids contained in it. As this boring penetrated well into the Liassic Clays, the details are of considerable geological interest; and the evidence it provided in regard to the underground water of this part of the county is of the highest importance to water-works engineers. The sequence of "formations" in the Crowland boring are found to be quite normal. On one occasion when the author visited the boring, he obtained a decided fossil belonging to the Upper Lias. This was a fragment 1 inch long of the outer whorl of an Ammonite (Am. bifrons), whose diameter would be about 3 inches. This was brought up before the Limestone (Marlstone 451 ft.-474 ft.) was entered.

A little water is reported to have come from the lower bed of Limestone or Marlstone; but in all probability this was an escape from the Lincolnshire Limestone down the outside of the tubes. A water-bearing bed must get its supply from an outcrop; and if the thin beds at the Stamford boring represent the Marlstone, then there is no apparent outcrop of this new bed sufficient to give it a water supply.

In an appendix will be found a number of analyses of South Lincolnshire waters specially prepared for the purpose of this paper by Dr. J. C. Thresh, M.D., D.Sc.. and presented by him to the Association. These are of extreme interest, as they represent samples obtained from typical wells in the Lincolnshire Limestone, from its normal condition on the west to its heavily charged condition on the east (as at Crowland), where the rock has thinned out. Dr. Thresh may possibly give the Association his observations on these analyses; but there is one result which deserves particular attention. The amount of dissolved calcium carbonate decreases from west to east, notwithstanding the longer travel of water through the Limestone Rock; while the sodium carbonate held in solution increases from west to east.

Now, bearing in mind that the Limestone decreases in thickness, and becomes more argillaceous as it extend eastwards, and that the Upper and Lower Estuarine beds are coming closer together, and would probably meet at no great distance east of Crowland, the conclusions forced upon us are that (1) the water contained in these beds is practically in a dormant condition, and, as a consequence, has been able to take up from the clay and adjoining beds increasing proportions of sodium carbonate together with other soluble substances; and (2) that the sodium carbonate has precipitated corresponding amounts of calcium carbonate.

In conclusion, the author briefly summarizes the principal lessons to be learnt from this brief study of the rocks of South Lincolnshire: (1) The chief water-bearing rock is the Lincolnshire Limestone; and this formation thins towards the east. (2) The Limestone, in addition to thinning out, becomes more argillaceous and closer grained, and thus ceases to be a good water-bearing rock. (3) There is a zone of water-bearing rock running in a north-easterly direction, the centre line of which may be taken roughly as the western edge of the Fenland. (4) This zone extends from a few miles south of the county boundary, and has a mean width of about nine miles. (5) In this area water is under hydrostatic pressure, and will often rise to 20 or 30 feet above the ground. (6) In all probability the Limestone dies out towards the east; and the clay beds above and below this formation meet and form a barrier, preventing the flow of underground water. (7) The water which is found in the Limestone beyond a certain easterly limit moves along with extreme slowness, or may even have remained practically quiescent for very long periods of time, with the result that it is now too saline and too heavily charged with mineral matter to be of use for ordinary dietetic purposes.

## Appendix.

*Analyses of Deep-Well Water in South Lincolnshire by*

Dr. J. C. Thresh, M.D., D.Sc., F.I.C.

Results in Parts per 100,000.

| | 1 Crowland. (Linc. Limestone.) | 2 Market Deeping. (Linc. Limestone.) | 3 Thurlby. (Gt Oolite.) | 4 Thurlby. (Linc. Limestone.) | 5 St. James Deeping. (Linc. Limestone.) | 6 Caythorpe. (Marlstone.) | 7 Near Peterborough. (Linc. Limestone.) |
|---|---|---|---|---|---|---|---|
| Colour | Lt. Yel. | Lt. Yel. | V. F. Yel. | F. Yel. | F. Yel. | Yel. | None. |
| Appearance* | — | — | — | — | — | — | — |
| Chlorine | 153·0 | 13·6 | 2·4 | 2·4 | 20·5 | 4·0 | 5 4 |
| Permanent hardness | 0·0 | 1·4 | 8·0 | 8·0 | 2·0 | 12·0 | 4·0 |
| Temporary do. | 6·0 | 7·6 | 15·0 | 17·0 | 7·6 | 22·0 | 16·0 |
| Total do. | 6·0 | 9·0 | 23·0 | 25·0 | 9·0 | 34·0 | 20·0 |
| Nitrites | 0 0 | 0·0 | trace. | 0 0 | 0·0 | 0·0 | 0·0 |
| Nitric nitrogen | 0·1 | 0 06 | 0·03 | 0·06 | 0·06 | 0·06 | 0·05 |
| Iron | trace. | 0·0 | 0·0 | 0·0 | 0·0 | 1·5 (Oxide) | 0·0 |
| Free ammonia | 0·160 | 0·056 | 0·004 | 0·002 | 0·080 | 0·014 | 0·020 |
| Organic ammonia | ·002 | 0·003 | 0·003 | 0·003 | 0·001 | 0·003 | 0·006 |
| Oxy. absorbed | ·083 | 0·072 | 0·039 | 0·029 | 0·025 | 0·020 | 0·013 |

* (1) Little deposit oxide of iron; (2. 3, 4, and 5) clear; (6) clear at first, very turbid after; (7) bright. Odour: None.

Full Analysis of Solids.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Carb. of calcium | 5·5 | 8·65 | 23·7 | 24·0 | 8·15 | 34·75 | 20·25 |
| Carb. of magnesium | 3·15 | 3·5 | — | — | 3·65 | ·65 | 3·5 |
| Sulp. of calcium | — | — | 3·4 | 6·45 | — | — | — |
| Sulp. of magnesium | — | — | 3·75 | 3·5 | — | 6·5 | — |
| Sulp. of sodium | 16·3 | 8·7 | 4·6 | 1·65 | 8·2 | 25·45 | 10·35 |
| Sulp. of potassium | — | — | — | — | 1·1 | — | — |
| Chl. of sodium | 244·2 | 22·45 | 3·95 | 3·95 | 33·3 | 6·6 | 8·9 |
| Carb. of sodium | 50·75 | 20·3 | — | — | 22·1 | — | 5·05 |
| Carb. of iron | ·35 | — | — | — | — | 2·2 | — |
| Nitrates, silica, &c. | 3·25 | ·4 | 1·1 | 1·45 | 2·0 | 1·05 | 2·85 |
| | 323·5 | 64·0 | 40·5 | 41·0 | 78·5 | 77·2 | 50·9 |

None of these contained more than a trace of nitrates, and are all very pure organically.

*Discussion.*

Dr. THRESH (in a written communication) said he was under the impression that waters containing carbonate of sodium were peculiar to the Thanet sands and chalk deep beneath the London clay near the centre of the London Basin. He had, however, found them in Derbyshire, at Ilkeston, at a depth of 870 feet, the boring having passed through various beds of coal and fire-clay; in Lancashire from the millstone grit near Lancaster, at a depth of 265 feet; in Kent, between Tunbridge Wells and Maidstone, and from the Hastings beds, at a depth of 830 feet; and in Staffordshire, where the water from a coal mine had been pumped to waste for years at the rate of 2 million gallons per day. In the Lincolnshire limestone, he first found it at Elton; in Northamptonshire, where the limestone was reached at a depth of 142 feet; and since then in the samples submitted to him by Mr. Preston. The amounts present varied exceedingly, as was shown in the following table:—

*Carbonate of Sodium Present*

| | In 100,000 Parts of Water. | In Grains per Gallon of Water. |
|---|---|---|
| Ilkeston (Coal measures ?) | 13 | 9·1 |
| Lancaster (Millstone grit) | 2 | 1·4 |
| Kent (Hastings sand) | 65 | 45·5 |
| Wolverhampton (Coal measures) | 9 | 6·3 |
| Elton (Lincolnshire Limestone) | 5 | 3·5 |
| Crowland (Lincolnshire Limestone) | 51 | 35·7 |
| Thanet sands (L. Basin) | 15 to 39 | 10·5 to 27·3 |
| Chalk | 1 to 40 | 0·7 to 28·0 |

He had also had such waters submitted to him from the Isle of Wight, and from deep wells near Portsmouth. The Isle of Wight well was several hundred feet deep, and yet had not so far touched the chalk. The water came from sands (probably Thanet) believed to be overlying the chalk. Almost invariably in waters containing much calcium carbonate, the amount of sodium carbonate was small and *vice versâ*. All the waters containing sodium carbonate were also characterized by the presence of sodium sulphate and sodium chloride. The peculiarity was well shown in the waters from Crowland and the Deepings [see table at end of paper.] In fact, the Lincolnshire limestone waters were so closely allied to those from the Thanet sands and chalk in Central Essex, that they could not be distinguished by comparison of the analytical results. Another point of importance was the fact that wells yielding waters containing much sodium carbonate yielded water in limited amounts. Mr. Preston's conclusions supported his—that such waters came from sources that were practically stagnant.

Mr. WILLIAM WHITAKER, F.R.S., F.G.S., commenced a speech of considerable length by observing that Mr. Preston was a water-works engineer, and a good deal more—he was a good geologist. It was seen in the paper that the author had a geological formation almost to himself—the Lincolnshire formation; and he had given them a fairly exhaustive account of its water-bearing properties. He had noticed the differences in the waters of the springs and marlstone, and their fluctuating yield. Most of them would sympathize with this, because they must know that springs and many other sources of supply were very much addicted to fluctuations. In some cases, they got perennial springs flowing in good quantity; but in springs of the sort which were dependable upon circumscribed conditions, they would vary with the rainfall. Dr. Thresh had done good work in dividing the water into two classes—chalk water and the water that contained the sodium salts. The author also alluded to the thinning out of the marlstone eastwards. It was with the careful records of wells in various parts of the country that chiefly they were getting such valuable information as to the underground formation and the thinning out of the beds. He was sorry to say they were very generally thinning out. The author had enforced, and he himself would emphasize, the need of the water engineer knowing something of the hydro-geological structure of the district with which he had to deal. When the author suggested that the rainfall of South Lincolnshire was small in comparison with other parts of the country, this (Mr. Whitaker showed) required a little qualification. In the first table Mr. Preston gave the rainfall of Boston for 21 years; and the average came to practically a little over 21½ inches. A statement which followed gave the average rainfall for Boston for something like 70 years; and this showed that it was nearly 2 inches more as an average. This indicated that, in rainfall matters, they wanted information over a large number of years. Another interesting point in the paper was as to the percolation through the boulder clay; and it was quite possible that for two reasons—where it was fairly thin, and the surface cracked, or through the boulder clay being of an exceedingly sandy nature,—that a certain amount of percolation might exist. Regarding the description as to the weathering of the Lincolnshire limestone, if they judged of limestone by what they saw in the 8, 10, or 20 feet at the top, they might reasonably think that they had tremendous porosity, because the top part was broken up into small fragments. If, on the other hand, they went below, they would find a different state of things. It would be discovered that the limestone was very compact, and that the joints were few and far between, so that they must not count simply on the top surface. It was valuable in that water went into it very rapidly indeed; but very likely it did not come so rapidly out of it. The author had alluded to the differing action of calcareous water. In many places, the water in passing through the limestone dissolved it; in other places, it deposited it. He emphasized the importance of records being made of the strata and results of wells and borings. He had often been in places where there was a series of wells, and nobody knew anything about them. The result was that a great deal of money was spent on some new well, with all its uncertainties, which might perhaps have been saved if only something was known as to what had been done before. He was glad the well sinkers of the country were now fully alive to the value of this, and kept records. As to the reference to the artesian well at Bourne, which yielded 5 million gallons a day, he suggested there had been a mistake in calculating the flow. The question was, of course, whether there was this daily outflow, or whether, if the whole of the 5 million gallons flowed out, some of it did not get back; and, if it did, he thought it ought to be kept from doing so in some way. As to the Crowland boring, they must sympathize with Messrs. Hodson and Son on the comparative failure of this boring; but no fault could be found with an engineer when an experiment of the kind was not a success. He drew special attention to Dr. Thresh's help in analyzing the waters from these deep borings, and agreed with him that it was extremely difficult to account for some of the curious results as to the sodium, potassium, and magnesium salts that were obtained in these waters. Dr. Thresh, in his letter, alluded to some of the waters giving a large amount of carbonate of sodium. In the Hastings sand water, they always got it. If there were 20 to 25 grains per gallon, they thought it was all right. Dr. Thresh noted a case of 45 grains; and he (Mr. Whitaker) believed there was one which went even up to something like 70 grains, which amounted almost to a mineral water. As a geologist, he must thank Mr. Preston for his very able paper. The Geological Survey had awakened to the importance of these water questions, and were putting their knowledge into a practical form. They had already published two sketches on the underground water supply of two counties—Berkshire and Sussex. The Geological Survey had annexed Mr. Preston, and got his help in the work for Lincolnshire.

Mr. G. HODSON (Loughborough) pointed out that the Crowland boring was not a failure in the ordinary sense. In this case, Crowland happened to be 4 or 5 miles from anywhere; and there were away to the west a great many bore-holes yielding water in large quantities. He explained the objectionable character of the existing water supply to the inhabitants of the district, and showed that something had to be done to help the people in their dilemma. But in sinking a well for them there was nothing to steer by; and they were most careful to explain to the authorities that it was a case of making a "pot-shot." It was decided that, on the whole, judging from the sections of the strata so far as they could do so, that it was worth while putting down a pioneer borehole. Their experiments showed there was the thinning out of the rocks to which reference had been made. They worked carefully on from day to day until they thought the time had arrived when they must give it up as a failure. He had thought they would get water enough to supply Crowland; but instead they only obtained salt water. He was of opinion that at some time the Wash must have extended right away above Crowland. If the water had been palatable, they could have got sufficient for their purposes; and in this sense the boring would have been a success.

Mr. W. MATTHEWS (Southampton), who 20 years ago was connected with the South Lincolnshire district, said at that time they had very little information upon which to work; and the conclusions to which they then came had been very much varied by what had been found out since. He was at the Peterborough works. There they had one of the oldest borings; but it was not utilized to the full extent that it might have been. He should like to know whether larger quantities of water could not be obtained from the neighbourhood of Wilsthorpe. The author was to be congratulated upon having had the collaboration of Dr. Thresh on the question of the deterioration of the waters from this formation as they went eastward. They showed the extraordinary increase in the sodium salts as they got eastward, and the peculiar decrease in the calcium salts; and the investigations here and those in Essex had at last brought them to the eve of discovering really the true cause why it was almost impossible to obtain water from some of the chalk in the oolitic district—getting on very much towards the east and in the direction of the sea. As to the rainfall, a period of 21 years was not a safe one to pin one's faith to; but generally an average for 30 years approximated closely to the average over any antecedent period. The author had gone closely into the question of the amount of available water owing to percolation in the limestone district; and he agreed with him that one-third was an exceedingly unsafe figure to take.

Mr. T. W. A. HAYWARD (Spalding) corroborated the author that the rainfall in the district was rather below the average. At Sudbury (where he was formerly), the rainfall had run as low as 15 inches; and the average for a great number of years—26 or 27 years—worked out to about 21 inches. He agreed as to the need for recording all particulars as to the sections of strata passed through when sinking wells, and mentioned a case where many wells had been sunk in a district, but there was not a single one in connection with which such records were made. There was in this instance nothing to guide them in sinking a new well. Although water was found in one spot, when they sunk a well 150 yards away (where it was thought likely they would be able to get a better supply), they could get no water at

all. He went on to refer to a unique experience at Sudbury. In 1869, when the water-works were first installed, they sunk a well in what they thought would be chalk formation. Immediately to the north of this spot—only 100 yards away—the chalk came up to the surface. They sunk a well about 75 feet, and no chalk was found. Then they proceeded with a 12-inch bore, and went down something like 50 feet before coming to the chalk; and then 200 feet lower they found a plentiful supply. They got 50,000 gallons an hour; and this went on satisfactorily until 1884, when there was an earthquake in the district. By some means, this acted upon the chalk or a fissure or something of the kind, and the flow was diminished to less than 30,000 gallons an hour. This continued until 1889; and then he was much surprised one day, on going down to the bottom of the well, to find the inflow increasing. From that time, it went on increasing until it got up to about 42,000 gallons an hour. The strange part was that what Sudbury lost through the earthquake, Colchester [which is 16 miles away as the crow flies] gained to about the same extent. As the Sudbury water began to come back in 1889, the Colchester water commenced to diminish.

Mr. JOHN SHAW (Boston) said with regard to the rainfall registered at Boston, some twenty years ago the Borough Engineer read a paper on the "Conservancy of Rivers and the Prevention of Floods;" and it was a peculiar thing that he then pointed out that the rainfall of Boston was gradually increasing. They seemed to have come to a culminating point in 1881; and since then to a certain extent it had gone back. In 1887, they registered about 12½ inches—practically 13 inches in Boston; and this was not the worst year they had had for water. The reservoir fell at that time to about 5 feet on the gauge; whereas in 1890-91 they got down to practically 2 inches above the bottom of the reservoir. He thought Mr. Preston had somewhat overrated the percolation in his paper. It might be that in Mr. Preston's district, the boulder clay was different from what it was in his (Mr. Shaw's) district. Another factor in regard to percolation that Mr. Preston had not taken into account—probably it did not affect his yield as much as it did in the part of the country away further north—was the vegetation. Where there was a large amount of vegetation on the ground, the percolation seemed to be much less than it was in parts that were practically bare. In regard to the supply that was stated to be given at Spalding, this appeared to be somewhat overrated. The amount coming from the Bourne borehole was given as something over 5 million gallons a day; and certainly Spalding did not take one-twentieth part of this water. He wondered whether the artesian borings round about Bourne affected the water supply in the district to the west. He heard that it did—that the level of the wells had fallen very much, and had varied more than ever they did before these boreholes were sunk.

Mr. C. C. SMITH (Wakefield) said he was connected many years ago with a reservoir in the Millstone Grit. There was a fault running parallel with the valley right across the trench. The engineer expressed doubts as to whether it would be possible to make the trench water-tight with this fault across it. As they went down the trench, he (Mr. Smith) found there was no water issuing from the fault, but that it had every appearance of being perfectly water-tight from top to the bottom of the trench. The material of the fault itself was water-tight—if not more so than any they met with anywhere else. The ground there was seamed with faults in all directions. However, the reservoir was completed, and proved perfectly satisfactory.

Mr. W. WATTS (Sheffield) had never yet had to do with an embankment in which faults did not exist either large or small. He regarded these faults as physical helps in the work of reservoir construction; and if engineers could so arrange their work as to take advantage of the line of faults, they were of material assistance. He had one now—a very large one—in the Little Don Valley. When they got down about 50 feet, the part of the trench on the southern side of the valley yielded 84,000 gallons of water per hour; on the northern side scarcely a drop of water came in, except what flowed from the surface. He thought that, in sinking wells and trenches, if engineers in charge of the works would study more seriously and practically the line of the faults, they would have less failures, and, he believed, would, as a rule, get a better supply of water.

Mr. JOSEPH PRICE (London) was interested in the suggestion as to the keeping of records. The leading firms of well-borers and contractors generally contributed to the geological records anything that was new; and it was of very great use to such firms to be able to refer to them. They fed with what they could the Geological Survey; and the Department in turn were good enough to feed the firms engaged in this work. He illustrated the trouble that was experienced through the absence of records. Then turning to the reference to the effect of an earthquake, he said that this was parallel to what he had found occur at times in attempting to open up a borehole by the use of dynamite. Sometimes they were successful in breaking through to a fissure; but they had had cases where the latter state of the boring had been worse than the first. When using dynamite, it crushed up the strata altogether; and it seemed to him that this might have occurred in the case of the earthquake, and possibly a certain amount of erosion had opened up the fissure again and relieved the constriction.

Mr. PRESTON, in the course of his reply, referring to the remarks that had been made on the question of faults, and the fact that there were often impervious beds of strata between, said that, wherever they came across sections of faults of this kind, he believed they were generally due to the squeezing of a lower bed of clay into the fault. Simple fissure cracks were also filled in this manner, and were not faults at all. If they saw them in a vertical section, as in a railway cutting, they could see they were not faults, but simply shrinkage cracks which had been filled by clay squeezed into the opening. In regard to what he (Mr. Preston) had said as to the 10 inches of percolation, it must be remembered that, in this particular district, they had a very big outflow of water. There were a considerable number of springs which he had not mentioned; but in the line of springs he had mentioned they had a number which were letting out a very large amount of water. This quantity of water, together with what was obtained from the artesian wells, must be accounted for by percolation. He dealt at some length with this point, and with the characteristics of the South Lincolnshire district, which led him to the conclusions stated in the paper. One definite point was that there were a considerable number of small areas which were completely cut off as outlets either from faults or denudation. He had got two or three of these areas under examination; and he believed that by and by he should be able to show very fairly the quantity of water coming out of them. One he might mention which he had examined somewhat fully was a catchment area of a little over 1000 acres; and from the springs that were issuing from this area and two artesian borings, he could quite safely say, they were getting 7½ inches of percolation at the latter end of the summer months. If they could get this at the end of the summer, then, he thought, taking the average of the year, they would find they were getting something near the 10 inches. This gave him the impression that the 10 inches would be a fair amount to suggest. Mr. Matthews had asked him what his ideas were about getting a larger quantity of water from Wilsthorpe. He had looked into this district a little; and he felt quite satisfied that there was, by engineering, a considerable increase to be obtained there. The wells that had been sunk for Peterborough were much nearer to the city; and possibly that was the reason they went to a fresh district for a supply. However, the underground storage in the neighbourhood of Wilsthorpe was very considerably above what they already obtained. With regard to the presence of sodium and other chemical constituents in water, he said that the result of his observations indicated to him that it was a matter that required further investigation. He was not able to go into this side of the question very fully, but if those having the ability would take up the physical, chemical, and microscopical study of rock formations as brought up from borings, then they would be able better to suggest what the cause of the variation in the chemical constituents of water was derived from. Very little, he believed, had been done in this way. Particularly would the record be useful where borings were in faulty or unknown districts, because many of these physical, chemical, and microscopical properties of rocks might be carried from place to place, or might be shown to be pretty constant in a uniform district. As to open and closed faults, he had considered this question rather considerably, and he could not remember where he had found what he should call a perfectly open fault such as in the sense he had mentioned; but he believed that the very physical action that caused faults had a tendency to make them absolutely water-tight.

---

**Gas-Engines for Electric Driving.**—A great drawback (says the "Electrical Review") in connection with the use of gas-engines coupled direct for electric driving is their unsteady running. Various firms have designed engines in which the fault is to a large extent overcome; and among those who have tackled the question is Mr. P. Burt, of the Acme Manufacturing Company, of Glasgow. The gas-engine which he has produced is a high-speed compound tandem machine; and it is claimed that it will compare favourably in steadiness of driving with the best steam-engines. In this Burt gas-engine each crank has above it a line of three pistons, the top and bottom pistons working on the ordinary "Otto" cycle, and firing alternately—thus having a compression at every up-stroke, and an impulse every down-stroke. But, instead of exhausting to atmosphere, they exhaust alternately into the bottom side of the centre or low-pressure piston. This on the up-stroke has the effect of expanding the exhaust gases to nearly atmosphere, at the same time considerably reducing the noise of the exhaust, as well as attaining increased economy in the working of the engine. The centre or compound piston while descending draws in a charge of cool air, on the top side, through the air-check valve on the air-pipe. This air on the up-stroke is slightly compressed; and at the end of each exhaust stroke, on the opening of the admission-valve in the high-pressure or explosion cylinder, it sweeps through the combustion space, clearing out the products of combustion, and at the same time assisting to cool the valves, pistons, and walls of the cylinder. The piston and piston-rods are made hollow, and a supply of cold water or cool air can be circulated through them when the engine is working. The design of the engine admits of simple construction and of the standardization and interchange of parts. The form of the combustion space permits of very high compression, and the governing is carried out by means of a variable cut-off; the gas and air mixture being increased or diminished in quantity as required for the power demanded from the engine.

## UNDERGROUND WATER SUPPLIES.

At the closing day of the recent Building Trades Exhibition at the Agricultural Hall, Islington, Mr. W. H. Maxwell, Assoc.M.Inst.C.E., the Borough and Water-Works Engineer of Tunbridge Wells, read a paper on the above subject before a gathering of municipal and water engineers. He acknowledged at the outset that he had not had sufficient leisure to enable him to go deeply into the subject, and therefore he could only offer a few general remarks upon it. He trusted, however, that they might serve to introduce some of the principal questions worthy of discussion by the meeting.

The author began by pointing out that, in his search for underground water, the engineer is brought into close practical contact with the subject of the geological structure of the district in which he proposes sinking for a supply; and he emphasized the importance of detailed information under this head. This, however, is not always available, although a great deal may be derived from the 1-inch maps of the Geological Survey, and further local details from the MS. maps on the 6-inch scale supplied by the Geological Survey Office for those parts of the country which have been so revised. The author was much gratified a few years ago to find that the data thus available are now being largely supplemented, in what appeared to him to be a most valuable form for the purposes of the water-works engineer, by the publication by the Geological Survey Office of a series of "memoirs" dealing with the underground waters of the different counties. Only two such memoirs have as yet been published—the first (1899) dealing with the "Water Supply of Sussex from Underground Sources," and the second with that of Berkshire. They each give details of a large number of well sections throughout the county, with particulars of the quantity and quality of the water obtainable therefrom, and other local geological information concerning water supply.

Having referred to the appreciative remarks of the Rivers Pollution Commissioners, in their report for 1874, on deep-well waters, and to the desirability of conserving and utilizing them, the author indicated some of the principal water-bearing strata, in geological order, commencing with the most recent, from which supplies have been obtained—viz., valley gravels and drift deposits, Bagshot beds, Reading beds, Thanet sands, chalk, greensand, Ashdown sand, Oolite, new red sandstone, and millstone grit. He pointed out that the water from the surface gravels is of doubtful quality, being obtained from shallow wells and more or less liable to pollution, and that it should be distinguished from deep well-waters obtained by borings into water-bearing strata situated beneath or between impermeable beds, such as the water procured by sinking through the tertiary formation into the chalk below in the London basin, or from the Ashdown sand lying beneath an impermeable bed of Wadhurst clay, where varying amounts of artesian head are met with.

The author went on to show that the quantity of water which may be abstracted by means of wells or borings from any contributing underground area will depend upon a variety of conditions; determinable to varying degrees of exactness. Among them he enumerated the following: (1) The boundaries or extent of the underground contributing area or watershed. (2) The area of outcrop of water-bearing strata, and the extent to which the slope of adjoining impervious areas may conduct the rain falling thereon to the porous outcrop. (3) The annual rainfall over the contributing area, and the proportion thereof percolating annually in at the outcrop, and ultimately finding its way to the underground store. (4) The degree of porosity or permeability of the water-bearing strata. (5) The quantity of water, or leakage, flowing out of the underground store, through natural outlets—as, for example, into the sea or the beds of rivers. (6) The percentage of the total percolation into water-bearing strata which is again recoverable by means of pumping-stations. The author confessed that to define with a reasonable degree of certainty the true contributing area was by no means an easy matter, and must always involve a close geological and physical examination of the country in the neighbourhood of the outcrop.

Rainfall and percolation were the next matters dealt with. Mr. Maxwell remarked that, with the records now available, the rainfall will usually be readily obtainable; but the question of the amount of "percolation" is a point involving considerable difficulty and uncertainty. This subject is of itself a large and interesting one; and, among other things, it depends on: (1) The manner in which the rainfall reaches the ground, whether in numerous slight showers or in heavy rains; (2) the time of the year when the greatest rainfall occurs; (3) the surface slope of the ground and the dip of the underlying strata; and (4) the nature of the soil or strata, and its degree of porosity or permeability. There is much difference of opinion as to the ratio existing between the percolation and rainfall in different classes of soil or strata, and the question is one upon which further observations and experiments are needed. In the case of the chalk, after considering all the available facts, the Royal Commission on the Water Supply of the Metropolis presided over by Lord Balfour, adopted the figure of 7 inches of percolation as an average out of an ordinary year's rainfall over the chalk area within the Thames basin; while during a succession of dry years this quantity may not amount to more than 4 inches per annum. On the other hand, observations of the quantity of water given off by a certain area of chalk have shown the percolation to amount to as much as 10 inches per annum. Touching upon the depletion of underground supplies, and the formation of the Underground Water Preservation Association last year for the prevention of the excessive abstraction of water, and the conservation of it for the use of the inhabitants in the district specially concerned, the author said he would not venture to predict to what extent these objects could be achieved, in view of the state of the law in regard to underground water, as recently settled by the well-known case of *Chasemore v. Richard's*.

In conclusion, Mr. Maxwell glanced at the various types of pumping machinery and motive power plant suitable for deep wells. He said that, for borings, the principal alternatives are: (1) Ordinary single-acting deep-well pumps; (2) double-acting or "concertina" type of pumps; and (3) raising water by compressed air. Where the well or boring is situated at the main pumping-station, the question of motive power is frequently readily solved by the use of steam from an existing boiler-house; but where the site is isolated, the comparative advantages and disadvantages of the various available alternatives must be considered, such as, for example, the use of (1) a steam pumping plant, (2) a coal-gas engine plant, (3) Dowson gas plant, (4) oil engines, (5) compressed air supplied from a distant station, and (6) electric power. The cost of procuring an underground supply, under ordinary circumstances, including payment of capital charges on works and working expenses, will, in all probability, be from about 3d. to 4d. per 1000 gallons delivered through a 1000-feet lift to the surface, if the plant is used to its full working capacity.

---

**Ferro-Concrete Water-Pipes.**—We learn from "Engineering" that since last year ferro-concrete water-pipes have been employed in Brussels to the extent of about 2½ miles—in diameters ranging from 23⅝ up to 31½ inches. The maximum head is 138 feet. For heads below 66 feet, the pipes are built upon a skeleton of steel bars of double T-section. A number of these bars run lengthwise of the pipe, and round them is wrapped a spiral of similar steel bars, the spacing of which is varied with the head to be withstood. The skeleton is placed in a vertical mould, which is then filled with a quick-setting cement. Each length of pipe is 10 feet, and the joints between successive lengths are made by means of a ferro-concrete sleeve, rendered tight by cement mortar. For greater heads, the basis of the pipe is a steel tube 1-25th of an inch thick, inside and outside of which is arranged a steel skeleton of double T-iron, such as those already described. The whole is then cased with cement.

**Wholesale and Retail Prices in 1902.**—We have had sent by Mr. H. Llewellyn Smith, the Deputy Controller-General and Labour Commissioner of the Labour Department of the Board of Trade, a copy of a valuable report just issued by the Department on the above subject, accompanied by comparative statistical tables for a series of years. It is the outcome of inquiries, extending over several years, into the course of prices in the United Kingdom; and though the results obtained are more complete with regard to some branches than others, it was deemed advisable to publish without delay those which had been arrived at, in view of the large amount of public attention now being devoted to questions affecting prices of commodities and the cost of living of the working classes. The portion of the volume devoted to wholesale prices consists of a series of 188 tables ranging over periods of years; but that relating to retail prices is naturally more restricted in scope, the available data being much less abundant. So far as is known, this is the first attempt to compile continuous records of the retail prices of commodities in this country; and a considerable portion of the second section of the report represents original research. It is hoped that the present record will, in future years, be enlarged and brought up to date; but, as it stands, it is a mass of statistics of the greatest utility to all interested in social and economic problems.

**The Chemistry of Colouring Matters.**—We have received the prospectus of the Department of Dyeing and Tinctorial Chemistry of the Yorkshire College, Leeds; and the Secretary (Mr. W. F. Husband) asks us to call attention to the special facilities afforded or the study of the chemistry of the colouring matters and for research work upon coal tar products. The aim of the Department, which has been endowed by the Clothworkers' Company, is to combine the high standard of scientific teaching of a university with the practical training of a technical school, and to encourage the prosecution of original investigation in what is unfortunately, in this country, the least studied branch of applied chemistry. The Yorkshire College is pre-eminently suited for a specialized study in colour chemistry, both on account of its fine equipment in this direction, and from its situation in close proximity to the great textile industries of Yorkshire and Lancashire. The lectures on the chemistry of the artificial colouring matters are delivered on Tuesday and Thursday afternoons during the first and second terms, and comprise the distillation of coal tar and the preparation of benzene, toluene, naphthalene, anthracene, and the intermediate products of colour manufacture. Students holding a degree of any university (English or foreign), or otherwise furnishing evidence of a sufficient previous training in pure chemistry and general science, will be admitted at once to the lectures and practical works of the Department, and become eligible for certificates.

# REGISTER OF PATENTS.

**Sulphate of Ammonia Saturators.**—Standfast, T. S., of Totton, Hants. No. 20,369; Sept. 18, 1902.

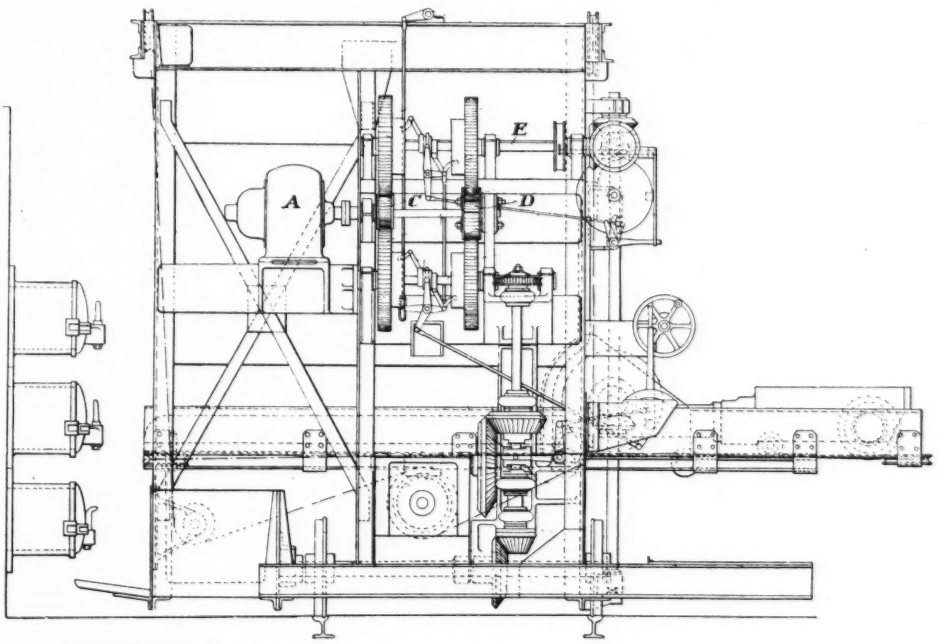
The patentee does not illustrate his specification, but thus describes his invention: A saturator having two main portions. (1) The sheet-lead tank, with necessary pipe connections to admit sulphuric acid and the ammonia from the ammoniacal stills which is absorbed by the acid. The joints of this sheet or cast lead are welded by the electric arc. Hitherto the oxy-hydrogen flame with a blow-pipe has been used for making such joints; but the joints so made are usually weak, and require frequent attention and repairs. By means of the electric arc, the lead is more thoroughly jointed, and the joints are much stronger and less liable to get out of repair. (2) The framework – of iron or steel or other suitable material – is made with a main member at each side of the saturator, if the saturator is rectangular in form, and the two main members are connected together by ties at each end of the saturator, in order to press them firmly against the lead tank. Lead lugs are used at equal spaces to keep the main lead body rigid, and can be disconnected from the framing without trouble. Intermediate horizontal and vertical struts are fastened by bolts or screws to the main members and to the ties. These struts are so arranged that they are in contact with the lead, with the object of supporting the lead and preventing it bulging when at work.

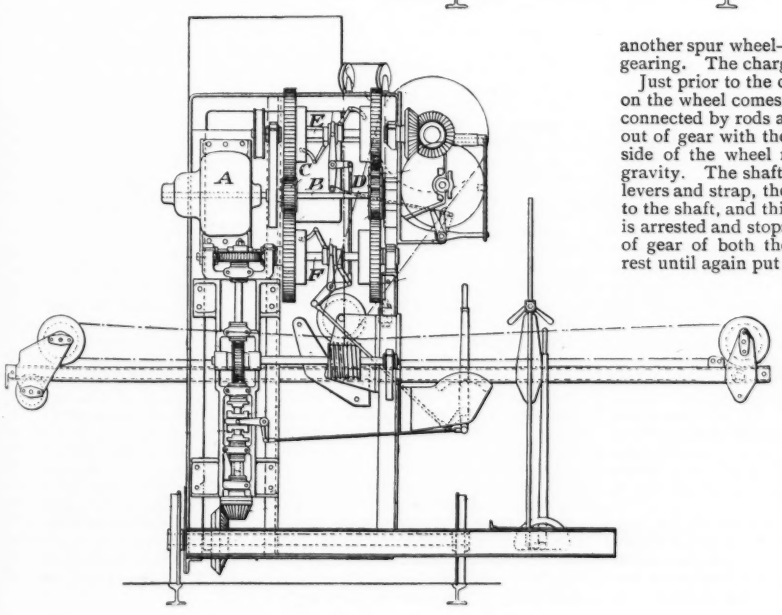
**Driving Gear for Retort Charging and Drawing Machines.**—West, J., of Manchester. No. 22,002; Oct. 9, 1902.

This invention—relating to the method of driving machines for charging and drawing gas-retorts—has for its object the application of an electrically driven motor and driving gear, arranged in such a manner that the several operations connected with the machines for charging and drawing retorts shall be put into and out of gear with the main electrically-driven shaft by friction or other clutches, which are first put into gear by the machine attendant and afterwards, in certain motions, mechanically thrown out of gear by automatic reversing and stopping gear which will operate on the levers and connecting rods, throwing the clutches out of gear when the charging of the retort by the charger has been completed, or when the rake drawing the coke out of the retort has returned to its place of rest in the machine.

The first illustration shows the charging machine, consisting of a framework mounted on wheels provided with gear for travelling the machine along the retort-house in front of the retorts, and hoisting gear for raising and lowering a coal-hopper and charger supported in a frame or track suspended from the coal-hopper. This gear is for the purpose of adjusting the charger so that it is brought opposite the retort to be charged. The present invention is the application of an electrically-driven motor A for driving the main shaft B, on which are fitted two trains of gearing. The wheels C and D are fixed on the motor shaft; and the former communicates motion to wheels running loose on shafts fitted with friction or other clutches which, when put into gear by sliding sleeves, impart motion to the shafts E and F. Trains of wheels revolve the shafts in either direction without the necessity of reversing the running of or stopping the motor. The shaft E drives the mechanism for sending the charger in and out of the retort; the shaft F, the mechanism for travelling the machine along the retort-house and raising and lowering the coal-hopper to the tier of retorts to be charged. The clutch gearing in connection with the wheels is put into gear by a system of levers and rods entirely separate from each other.

During the operation of driving the gear for sending the charging scoop into the retort, a wheel has been communicating motion to another wheel provided with a tappet, which, after a certain portion of the revolution, comes into contact with a lever connected to the clutch sleeve by rods and levers; and the motion thus imparted draws the clutch out of gear from the spur wheel and puts a clutch into gear with another spur wheel—thus reversing the direction of the motion of the gearing. The charger is then withdrawn from the retort.




Just prior to the charger coming to rest in the frame, another tappet on the wheel comes into contact with the lever shown; and this being connected by rods and levers to the clutch sleeve, the clutch is thrown out of gear with the wheel, and at the same time a cam path on the side of the wheel releases a lever having a weight which falls by gravity. The shaft of the lever, which is fitted at one end with brake levers and strap, thereupon tightens the strap on the brake wheel fixed to the shaft, and this is so adjusted that the motion of the clutch sleeve is arrested and stops in its central position. The clutches are then out of gear of both the wheels, and the gearing for the charger comes to rest until again put into action by the hand lever.

The application of the invention to a drawing machine is also shown. The mechanism described in connection with the charging machine for driving the charger in and out of the retort will similarly apply to the drawing machine for the purpose of driving the rake in and out of the retort; also the gear for travelling it along the retort-house and raising or lowering the rake-bar to the tier of retorts from which the coke is to be drawn.

**Strengthening Mantles Used in Incandescent Gas Lighting.**—Smith, H. S., and Mollart, C. H., of Stoke-on-Trent. No. 22,767; Oct. 20, 1902.

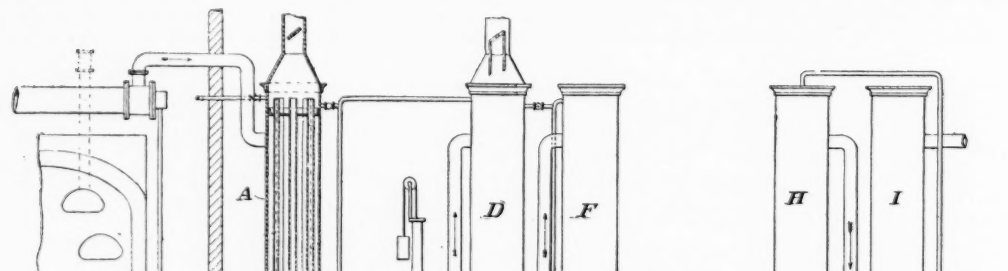
The patentees propose to make one gallon of a solution consisting of about ½ oz. of calcined

china "biscuit" pitcher with 2 oz. of ground chalk, and to add thereto 1 oz. of alum and 1 oz. of borax. These are mixed together and then ground to a fine powder. There is then added 1 oz. of calcined bone, 2 oz. of saltpetre, ½ oz. of lump ammonia, and 1 oz. of sweet nitre, with sufficient cold water—that is, water having the temperature of the surrounding atmosphere—to make a gallon of solution. After straining through silk lawn or sieve, the liquid may be sprayed over mantles used in incandescent gas lighting, either before or after they have been impregnated with earthy oxides.

**Purifying Coal Gas to Prevent Loss of Illuminants during the Operation.**—W. C. Holmes and Co., of Huddersfield; a communication from O. N. Guldlin, of Fort Wayne, Indiana, U.S.A. No. 11,750; May 22, 1903.

This invention relates to the treatment of coal gas during the purifying and (particularly) the condensing operations, to prevent loss of volatile hydrocarbon illuminants by absorption by the tar. It may be stated, in general terms, to consist in effecting a regulated and uniform reduction of the temperature of the gas with the intermediate extraction of tar at a temperature above 90° Fahr., by dry mechanical precipitation, whereby the absorption of volatile hydrocarbon illuminants by the tar is prevented, after which the gas is gradually cooled to about 60° Fahr., and the extraction of the ammonia compounds is then effected at such lower temperature. The apparatus described embraces primary and secondary condensers, means for regulating the supply and flow of cooling fluids—such as air and water—through the condensers, an intermediate tar-extractor, and the necessary details for effectively operating the apparatus.

The illustration shows a sectional elevation and a top plan view of the entire apparatus—including a washer, scrubbers, drain and separating tanks, and connections.







The gas leaves the hydraulic main at a temperature (say) between 140° and 160° Fahr.; and, in order to reduce it to the proper temperature for the effective and economical extraction of tar without loss of illuminants, it is first passed through the primary tubular condenser A, constructed with upper and lower tube sheets or heads, through which are connected vertical air and water tubes. The bottom of the shell is provided with air inlet openings, which communicate with the air-tunnel B in the foundation, which extends, preferably, to the outside of the building. The openings may be closed by hinged plates or slides. The transverse baffle-plates are secured to the inner wall of the shell, alternately at opposite sides as shown. They serve to deflect the gas back and forth around and in contact with the cooled tubes, until it passes out through the pipe which connects with the exhauster C. At the top, the condenser is provided with a hood, in which latter is placed a regulating damper or valve to control the amount of air passed through the tubes according to the make of gas and the temperature of the outer air. It is important, says the patentee, that the temperature of the gas passing through the primary condenser be controlled so that it will leave the condenser at a temperature not less than 90° to 100° Fahr., and preferably between 90° and 120°, at which the remaining tar is removed.

The secondary condenser D is substantially like the primary condenser. The upper tube sheets or heads are, however, secured a short distance below the upper ends of the tubes, so as to form a water receptacle or pan. The gas-pipe connecting the lower end of the shell of the primary condenser A with the exhauster is in turn connected to a mechanical tar-extractor E, of any suitable construction, but preferably of the Pelouze and Audouin type. The tar-extractor is connected with the upper part of the secondary condenser D, and a pipe connects the lower end of the tube-chamber of this condenser with the upper part of the multi-tubular water condenser F (constructed in any well-known manner), provided at the bottom with an inlet water-chamber, and, at the top, with an outlet water-chamber, open or closed at top. The outlet gas-pipe connected to the lower end of this chamber leads to the gas-washer G.

The scrubbers H I are preferably filled with any material by which a very large washing surface is obtained per cubic foot, thereby materially reducing the size of apparatus required. They are supplied at the top with water and ammoniacal liquor in the usual manner. In the washer and these two scrubbers, the ammonia and its compounds are extracted from the gas while it is at a temperature of about 60° Fahr. The primary scrubber H is connected at its lower end by an overflow trap pipe with the washer G, for supplying the weak ammonia water with which the gas is treated in the washer. The washer is connected by an overflow pipe with the drain pot or tank J. The scrubbers also are connected with the drain pot K, from which ammoniacal liquor flows into the tank J. An ammonia water pump L is connected with the tank and pumps the ammoniacal liquor into the top of the primary scrubber H. In practice, fresh water will be supplied to the top of the second scrubber by a pipe or tipple.

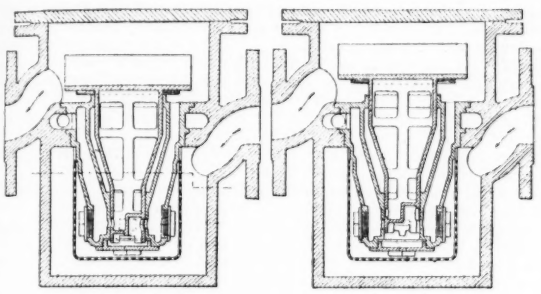
A tank M serves as a receiver and separator for tar, light oil, and ammonia water, and in practice will have outlets for these different products to wells or tanks. A separator tank N is placed adjacent to the retorts and to the primary condenser, and with it is connected a tar-pipe from the hydraulic main and a drain pipe from the primary condenser. In this tank, a considerable amount of caustic ammonia will be contained in the ammoniacal liquor separated from the tar and oil, and such caustic ammonia is passed into the drain tank J, where it mixes with the ammonia water, and is pumped thence into the top of the first scrubber or into the washer, or both, to assist in removing carbonic acid and sulphur compounds.

In this construction of plant, the three condensers are made of a combined capacity for reducing the maximum make of gas from about 150° Fahr., in the hydraulic main, down to about 60° when entering the washers and scrubbers, where the ammonia is eliminated. For instance, in a works having a capacity of 500,000 cubic feet per day, there would be provided a primary condenser A having a capacity of about 100,000 cubic feet per day, a secondary condenser D having a capacity of about 140,000 cubic feet per day, and the multi-tubular water condenser F having a capacity of about 312,000 cubic feet—based on the requirement that each condenser was to reduce the temperature of the gas from the maximum of 150° to the minimum of 60° Fahr. The combined capacity of the three condensers would be about 552,000 cubic feet per day, giving a margin of 10 per cent. excess capacity. It will be evident, says the patentee, that with this construction and relative capacity, the primary condenser could not reduce the whole volume of gas to 60°—in fact, it will reduce the temperature of the whole volume only to above 100°. But the succeeding condensers will gradually and slowly reduce the temperature down to about 60°. By means of the regulating damper above the primary condenser, the temperature of the volume of gas varying from day to day, or from month to month, may be uniformly controlled.

**Valve Apparatus for Combined Liquid Meters.**—Siemens Bros. and Co., Limited, of Queen Anne's Gate, S.W.; a communication from the Siemens and Halske Aktien Gesellschaft, of Berlin. No. 7781; April 3, 1903

This invention relates to the combination of a large meter for measuring a large supply of liquid and a small meter for measuring the supply when small.

In the specification of the German patent No. 77,398 was described an arrangement of valves for such combined meters, wherein each meter was provided with a separate cut-off valve, so arranged that when the one valve was opened to allow the liquid to pass through the corresponding meter, the valve of the other meter was closed. The present invention relates to an arrangement of apparatus whereby a rapid opening and closing of the large valve leading to the large meter is effected by a suitable variation of the conditions of the hydraulic pressure above and below a partition of the valve-slide.



The construction of the valve apparatus is shown in a vertical section with the lower position of rest of the valve slide; also the position of the parts when the large valve is partly opened.

By means of the partition, the supply chamber of the valve-casing is separated from a lower space communicating with the space behind the large valve. In this lower space, there is produced a suction action under the lower partition, which increases the load on the valve, and thereby ensures its closed position, during which time the communication with the small meter is open. In connection with the lower partition, there is also provided an opening in the valve-casing which, on the increase of the liquid supply, and the resulting raising of the main valve, establishes communication between the upper or supply side of the lower partition and the underside, whereby the suction action is destroyed and a balance of pressure is established above and below the partition at the moment when the valve slide rises. By this means, a sudden reduction of the load on the valve is effected which enables it to rise very rapidly; while, on the closing of the main valve when the supply is reduced, the action takes place in the reverse order—the suction action below the partition being re-established at a certain point of the closing, which increases the load on the valve and causes it to close quickly.

**Toughening or Stiffening Incandescent Mantles.**—Thompson, W. P.; a communication from R. Eisenmann and J. Bendix, of Berlin. No. 15,696; July 15, 1903.

This process for rendering collodion wool soluble in alcohol for the purpose of producing an immersion bath for incandescent mantles comprises the addition of a mixture of glacial acetic acid and acetone, or other cetones, to a mixture of collodion wool and alcohol, with the object (by the additions of cetones) of increasing the property of glacial acetic acid for dissolving collodion wool.

The following is stated by the patentees in order to allow of the invention being better understood: While the property of glacial acetic acid and acetone for rendering wool soluble is so great that such a solution retains its homogeneity even after the addition of a large amount of alcohol, which is not the case where acetone alone is used. If, in fact, collodion wool be dissolved in acetone alone (instead of glacial acetic acid acetone) and much alcohol be added to the clear solution, wool is precipitated from the solution. This experiment shows that glacial acetic acid acetone behaves differently from either acetone or glacial acetic acid alone. The invention is therefore no mere sum of known effects, as it is known that the solvent property of glacial acetic acid and acetone exceeds that of its components.

The process in practice is carried out somewhat as follows: 10 parts of collodion wool are dissolved in about 65 parts of glacial acetic acid, which contain 15 parts of acetone; and to this solution about 250 parts of ethylated alcohol (95 per cent.) is added, and the whole agitated vigorously for some time. In place of acetone, other cetones may be used. Ethyl-alcohol may also be replaced by other alcohols—for instance, by methyl-alcohol.

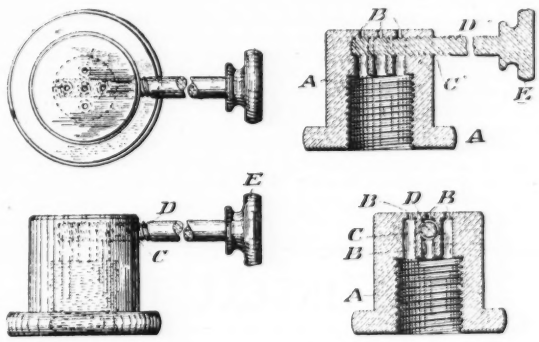
**Adjusting the Gas Supply to Incandescent and other Atmospheric Burners.**—Bray, G. & J. W., of Leeds. No. 15,729; July 16, 1903.

In their specification, the patentees remark that hitherto there has been difficulty in increasing or decreasing the supply of gas to incandescent burners without at the same time increasing or decreasing the pressure of gas at the gas-nipple—that is, at the point where the gas enters the bunsen tube or mixing-chamber. As the motive power for drawing in the air to such burners is the gas under pressure, it is obvious that variation of pressure varies the air supply. They claim that they are enabled to increase or decrease the gas supply without interfering with the gas pressure at the gas-nipple—that is, at the point where the gas enters the bunsen tube or mixing-chamber.

The illustration shows a plan of a gas-nipple constructed according to this invention, an elevation of same, and sectional elevations taken at right angles to each other.

In the gas-nipple A, holes B are made of suitable size to pass the required quantity of gas; and, by preference, these are counter-bored to form a recess to each hole on the underside. In the event of there being (for example) five holes in the nipple, one central hole is surrounded by four other holes in a circle, so as to leave three holes in a straight line. Intersecting the three holes in the counter-bored part, is a hole C, reaching nearly across the gas-nipple, and in it is a screwed plug D, which practically fits the tapped hole C.

To increase or decrease the supply of gas to the burner, the screw plug D is screwed so as to cover or uncover, wholly or partially, one or more of the three holes B, thereby increasing or decreasing the gas




supply to the mixing-chamber, leaving the remaining holes to give the necessary gas supply at practically unaltered pressure.

A second method of accomplishing the same object is to have the holes in the nipple A placed in such order that they may be covered or uncovered by the movement of a cap or slide, working, by preference, over the top of them. A third arrangement is to have the holes in one or more lines in the nipple. For instance, six holes may be placed in two lines of three each; and the slide or cap would in that case have in it a slot which would just leave uncovered the six holes. A fourth method is to drill a plain hole intersecting the line of the three holes in the nipple, and insert therein a plug having the necessary holes or gas-ways formed therein to correspond with the three holes in the nipple. This would allow of one hole being closed by moving the plug round a little, and, by another similar movement, closing the second hole, and so on to the third, as may be required.

## APPLICATIONS FOR LETTERS PATENT.

18,710.—Cook, D., "Chambers for the combustion of fuel under pressure; valves, purifiers, loading apparatus, and air compressors in connection therewith; and means for applying the gaseous products to smelting, steel making, and the production of electricity." Aug. 31.

18,747.—Watel, H. G., and Seagrave, G., "Acetylene gas lighting." Aug. 31.

18,769.—Kuljis, J., "Acetylene gas-generators." Aug. 31.

18,889.—Clayton, R., and Whitehouse, E., "Condensing atmospheric gas-heating stoves." Sept. 2.

18,904.—Ruscoe, J., "Self-sealing retort-mouthpiece." Sept. 2.

18,929.—Beal, W., "Inverted incandescent gas-burners." Sept. 2.

18,948.—Page, S. E., "Acetylene generators." A communication from the J. B. Colt Company. Sept. 2.

19,000.—Martin, F. S., "Gas-cocks." Sept. 3.

19,007.—Browne, A. F., "Gas producers or generators." Sept. 3.

19,027.—Platt, J., "Gas-burners." Sept. 4.

19,033.—Moore, A. E., "Gas and vapour engines." Sept. 4.

19,040.—Hume, G. W., "Gas-burners." Sept. 4.

19,079.—Boult, A. J., "Acetylene gas-generators." A communication from J. Kogel. Sept. 4.

19,130.—Lea, J. W., and Perrins, J. H., "Incandescent gas-lamps." Sept. 5.

**Ballymena Gas-Works Purchase.**—The Local Government Board have advised the Ballymena Urban District Council of their sanction to the loan of £29,000 for which the Council applied for the purpose of purchasing and extending the local gas-works. The repayment of the loan is to be spread over a period of forty years.

**Incandescent Gas Lighting at Swansea.**—Mr. T. Merrells, the Chairman of the Streets Committee of the Swansea Corporation, said at their last meeting that he had come to the conclusion that the flat-flame lamps were very expensive and unsatisfactory; and he suggested their conversion to the incandescent system. The yearly cost was £810, as against £340 for incandescent burners. The cost of the conversion would be £106, leaving a net profit of £363, added to which the incandescent light was superior. After discussion, the Committee decided to proceed with the change in regard to those lamps which were not likely to be converted to electricity in the near future.

**New Joint-Stock Companies.**—The Crieff Gaslight Company was registered in Edinburgh last week, to carry on the business of both gas and electric lighting undertakings. The capital is £14,000 in £1 shares. The public are not invited to subscribe. The Star Inverted Incandescent Burner Company has been registered with a capital of £1000 in £1 shares. The object is to adopt an agreement with J. Altman and H. Maisner for working under licence certain letters patent for improvements in inverted incandescent gas-burners, and to carry on the business of burner manufacturers and dealers, makers and vendors of incandescent, electric, and other goods usually stocked by ironmongers, gas-fitters, and kindred trades. There will be no initial public issue, and the Company was registered without Articles of Association.

# CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

## The Fiscal Question and Gas-Works Plant.

SIR,—If this letter should appear to be somewhat belated, the holidays must be my excuse.

I am extremely sorry to feel that Mr. Willey's "open letter" to his workmen does not appear to improve the position so far as he is concerned. Indeed, he makes it clear that there is to be no compulsion, only you must; no opinion but his own upon a matter that is likely to affect his workmen much more closely than it can affect him. Less remediable, perhaps, than this is his appeal to cupidity and ignorance. All kinds of good things are in store for his workmen, if they will join him in helping to build up a tariff wall around these islands. "Down with machinery!" was the old cry of the British workman. "Restrict the output!" is the motto of the modern Trades Unionist. "Shut out the foreigner!" is the demand of this prosperous manufacturer. Where is the difference between these, if the latter be not the most culpable of the three, because of his advantages of position and of education?

15, *Victoria Street, S.W., Sept.* 11, 1903. CHAS. HUNT.

# LEGAL INTELLIGENCE.

## Household Gas-Stove Company.

In the Vacation Court on Sept. 2, Mr. Justice Walton appointed a Receiver of the defendant Company's property in the case of *Hume v. Household Gas-Stove Company, Limited*. Counsel for the plaintiff said the Company did not appear; but the Secretary was in Court, and did not oppose the motion. The terms of the plaintiff's security as debenture-holder had become enforceable; there being an execution creditor in against the Company, and there were several other judgments against them. Liberty to apply for a Manager also was given, subject to proof being adduced that there was something to manage.

## Charge of Fraud against Mr. J. E. Addicks.

According to "Progressive Age" for the 1st inst., in the United States Circuit Court at Wilmington, Del., the Receiver of the Bay State Gas Company of Delaware, on the 20th ult., filed a bill of complaint against J. E. Addicks, J. F. Allee, and others, alleging fraud in connection with a transaction involving the stock of the Company, said to be valued at $75,000,000. The bill charges the defendants as Directors (except Addicks) with entering into an unlawful combination to issue to Addicks $1,500,000 shares of stock of the Company without consideration. The bill further asks that Addicks be ordered to deliver to the Receiver for cancellation certificates for the $1,500,000 shares of stock; that an accounting be made of the damages and loss sustained by the Company in consequence of the alleged fraudulent and unlawful issue of stock; and that the defendants be ordered to pay an amount equivalent to the alleged damage and loss. The defendants are required to appear and make answer on the first Monday of November. The stock is alleged to have been transferred on July 3, 1902. The allegation is made that the stock was issued to a New York broker, who is said to have been employed by Addicks to sell the stock. It is further set forth that, of the $75,000,000 of stock, Addicks is believed to still control a large portion.

## Stealing Gas at Dewsbury.

At the Dewsbury Borough Court last Tuesday, a cycle agent, named Siddal, was charged with an offence under section 18 of the Gas-Works Clauses Act, and pleaded guilty. Mr. H. Ellis (Town Clerk), who prosecuted, said defendant had fixed a pipe to the gas-mains belonging to the Corporation without having the consent of the Corporation. By this means he was able to obtain gas without it passing through the meter. Mr. G. W. Fligg, an official of the Gas Department, stated that he visited defendant's premises and discovered that a connection had been made with the gas-mains. He exhibited in Court a length of piping to illustrate how this had been effected. The pipe connecting the gas-main with the meter could be screwed off and another substituted. To the latter a rubber pipe could be attached and gas obtained without going through the meter. He described the arrangement as an ingenious one, and added that the proper connection could be restored in a few minutes. Defendant said he was very sorry for what he had done. He also stated that his meter was not large enough. A fine of 40s. and costs was imposed.

**Fatal Fall from a Gasholder.**—An inquest was held last Tuesday on the body of Stephen Cotgrove, a labourer, who was killed by a fall from a holder at the Southend Gas-Works. Deceased was engaged painting the holder; and at the time of the accident he and another man were shifting the ropes which held the "cradle" from which they worked. His mate was on the top of the holder, while deceased was in a kneeling position on a cross-frame about 10 feet below. He was hauling up a slack rope, when he appeared to lose his balance, and fell to the ground below, a distance of about 90 feet. The Manager (Mr. F. Clark) said he considered the work was quite safe. The Jury returned a verdict of "Accidental death;" but stated that, in their opinion, deceased and his companion should have been assisted by an extra man.

# MISCELLANEOUS NEWS.

## GAS-WORKS DAMAGED BY THE GALE.

### Holder Wrecked at Portsmouth.

It was hardly to be expected that gas-works would entirely escape the destructive effects of last Thursday's great gale; and there seem to have been two cases, at least, in which serious damage resulted. A large holder, which has during the past year been under construction for the Portsea Island Gas Company, and which was nearing completion, was completely wrecked. It is stated that the massive steel standards, 140 feet high, were bent and twisted like reeds; and that some of the heavy pieces of ironwork smashed into the holder. Not one of the twenty standards was left intact; and one of the girders, in falling, smashed down the contractors' office and the stores. Fortunately there was only one man near at the time; and he was in the boiler-house. Shortly after 10 o'clock, he was warned by the groaning of the structure as it began to give way; and he rushed out just before one of the standards fell within a few inches of the door of the house. A huge derrick near by was completely wrecked. The tank is being built by Messrs. E. Nuttall and Co., of Manchester; while Messrs. C. & W. Walker of Donnington, are the Engineering Contractors. The Merthyr Gas-Works are reported to have sustained damage estimated at £200. The ventilator of the retort-house was blown off, and struck the chimney-stack, carrying away about 20 feet; and a sheet of iron 15 feet square was hurled 100 yards, and crashed through a house. At Clevedon, a large number of lamps were damaged—in fact, practically all had glass broken or were otherwise injured. Thanks, however, to the efforts of the Gas Manager (Mr. J. Harger Pye), the lighting arrangements were not interfered with the following evening, the repairs having meanwhile been effected. Mr. Pye states that the pressure-register on the delivery mains at the works showed an oscillation of 5-10ths, and at his house nearly half-a-mile distant 4-10ths. He also mentions the fact that the gale occurred on the anniversary of the hurricane which wrecked Barbados four years ago.

## SHEFFIELD UNITED GASLIGHT COMPANY.

The Ninety-seventh Ordinary General Meeting of this Company was held last Tuesday, under the Presidency of Sir FREDERICK T. MAPPIN, Bart., M.P.

The GENERAL MANAGER and SECRETARY (Mr. Hanbury Thomas) having read the notice convening the meeting,

The CHAIRMAN said: In the report and accounts you will find that we have made a profit of £48,904 during the half year. After paying in dividend £43,424, you will have a balance of £5480; making the amount to carry to the present half-year's accounts £36,977. The reserve fund, as you know, is at its maximum. The reduction of 2d. per 1000 cubic feet for the last three months makes the charges for gas 1s. 10s., 1s 8d., and 1s. 6d.—the lowest prices the Company has charged since it has been established. In making this profit, we have paid £9194 less for coals and £2500 less for repair of mains and services; and we have received £1088 more for coke, £2935 more for tar, and £547 more for sulphate of ammonia. On the other side of the account, we have received £5484 less for gas, on account of the reduction in price during the last three months, and £754 less from the fitting department; and we have paid £6272 more for repairs of works and £537 more for salaries. Therefore I think that the result of these payments and receipts is satisfactory to all of us, and indicates that the future is extremely favourable. We have made 1119 tests during the half year, and the average illuminating power has been 17·39 candles; our standard being 16·5. We have sold 1,316,715,000 cubic feet of gas, compared with 1,331,497,000 cubic feet in the corresponding period of 1902. This is a reduction of some millions; but I think in all other respects the results are satisfactory. The leakage, or unaccounted-for gas, was 6·07 per cent. against 5·32 per cent. in 1902. We have fixed 22 additional gas-engines during the half year. The gas consumed by all engines during the twelve months was 218,142,000 cubic feet—an increase of 12,820,000 feet. We have sold 355 gas-fires and 519 boiling stoves and grillers during the six months, and have let on hire 130 additional cooking-stoves. A remarkable thing is that we have fixed 3529 additional meters during the past twelve months (mostly 3-lights)—a larger number than the Company have ever been required to fix before. Formerly, when trade has been falling off, the additional meters fixed had also a tendency to do the same; but this has not been the case during the last six months, and in searching for the cause we concluded it was the incandescent burners which had been fixed in small houses where people had hitherto been content to use the old oil-lamps. It is quite natural that a man, seeing his neighbour's house flooded with light from one of these burners, should not be content with oil, but would replace it with gas at a cost of 1s. 10d. per 1000 cubic feet. I have no hesitation in saying that this is the most economical light a man can use. Nearly a hundred years ago gas was introduced for lighting; it is now more popular than at any other period. It can be used in so many ways; and it is, in my opinion, a most indispensable servant. The sale has increased, but the price has decreased. The improved burner has placed gas beyond the competition of electricity for lighting purposes. For heating and as fuel, and for motive power, no limit can be placed on its future success. Gas, when used with Welsbach burners, is vastly cheaper than electricity. I have no hesitation in saying this; and I think I shall prove it to you in a few minutes. Our streets, I am glad to say, are now rapidly being lighted by incandescent gas-lamps, giving, in my opinion, every satisfaction at far less than we used to pay for the old mode of lighting. To prove my statement, I will give you the cost of lighting by means of gas the whole of the streets for the twelve months ended March 31 last.. We

have 5170 flat-flame burners, which consume 5½ cubic feet of gas per hour at a cost of £1 14s. 2d. each per year; and the amount paid by the Municipality to the Gas Company is £9680. We have also 6602 incandescent burners consuming 4 cubic feet of gas per hour. They cost only £1 4s. 10d. per year, instead of £1 14s. 2d., and give a very different light. In some places we have four burners, which are at midnight reduced to one burner; and the cost of these four burners per year is £3 10s. 3d. The amount paid by the Corporation for the 6602 incandescent burners is £6222; being £3458 less than they have paid for 5170 flat-flame burners. This should convince everybody that it is worth a little trouble to change the old mode of lighting and use the new style. Altogether the cost of lighting the streets of Sheffield by gas is £15,902. We charged 1s. 8d. per 1000 cubic feet up to March 31, which is the date to which the figures I have given apply. But the present price is 1s. 6d., or a reduction of 10 per cent.; and this makes £1590 less to be paid by the Corporation than before. No town, in my opinion, is lighted better than Sheffield; and I ask myself the reason why. We have no electric arc lamps, except those around the Town Hall; and you who have seen them can say whether they are as satisfactory as our own incandescent gas-lamps. Many cities and boroughs have spent large sums of money on electric lighting—much to their regret I am sure, and with no advantage to the ratepayers. The Dublin Corporation, after spending £300,000, have erected between 400 and 500 electric arc lamps, the current for which is to be charged to the Paving and Lighting Committee—why, they do not say—at the rate of £25 per lamp per annum. So that a sum of upwards of £11,000 will appear every year in the accounts, instead of about £2000 now annually paid for gas for the same area. The Islington Borough Council have been charging themselves 3½d. per unit for public lighting; and the Treasurer stated that the loss had been £6015 per year, because they had charged themselves less than it cost them. At a meeting on Aug. 7, it was proposed that three roads should be lighted by electric arc lamps. Alderman Cufflin moved, as an amendment, that incandescent gas be used instead. If electric lights were adopted, he said, the cost for current and maintenance would be £1138 per year, and the cost of lighting the three roads by gas would be £185 per year. He said also that their streets in 1894 were lighted at an annual expense of £14,645; while the estimate now brought up for lighting was £32,001—an increase of £17,356 in ten years. Mr. Stonelake advocated every road, court, and alley in the borough being lighted by electricity; and Mr. Lemon said at the present time only one-fifth of the borough was lighted by electricity, costing £18,000 per annum. It was resolved, after discussion, by 24 votes to 13, to light one of the roads by electricity and the other two by incandescent gas. In building new houses, it is often the practice for municipalities to wire them for electricity only, and ignore gas. The Battersea Municipal Council deny the use of gas to the occupants of their rate-provided dwellings. The reason given is that they will be able to use the electric light at a less cost than the price of gas in the district (2s. 3d. per 1000 cubic feet). How this argument is to be proved, I cannot tell. Battersea's price to tenants is to be 4d. per unit by slot meters; and these unlucky people are not to be permitted to use gas at all for cooking, heating, or lighting. At a meeting of Municipal Electricians, Mr. Kennedy said the Electricity Committee of Glasgow were astonished to find their incandescent light could not compare with the incandescent gas-burner. After spending more than £1,250,000 on electricity for lighting, it was Mr. Kennedy's opinion that in future it would be necessary to look more to other uses for electricity. The St. Olave's (Bermondsey) Guardians had a report upon their electrical installation at Ladywell Workhouse. An expert was called in, who found the wiring wrong, and said it would cost £1500 to put the installation in proper order. It was discussed, and finally decided to expend the £1500; and if the installation was still unsatisfactory, it would be abandoned. In March last, I referred to the heavy cost of electric light to railway companies. I instanced the Midland Railway, which, for their eleven stations so lighted, paid (for two half years 1901 and 1902, as published by Mr. Langdon, their Chief Electrician) £53,820, and for one goods station only—the Wicker, in Sheffield—£3855 for twelve months. For lighting all their sixteen stations in and around Sheffield with gas, the cost was £3176, against £3855 for lighting only part of their Wicker goods station by electricity. On June 16, I received a report in reply to my statement; but the calculations are taken on a wrong basis—viz., that their electric arc lamps give an illumination of 1500-candle power. There is no arc lamp giving that amount of light; 500 is much nearer the mark. It is useless for me to deal with the Midland Company's reply on such a basis. They say also that the Wicker electric plant was laid down ten years ago, and is now old-fashioned. I should be surprised if that is the real reason. All railway companies are not so strong financially as the Midland Railway; but they will act wisely in the interests of economy if they replace their electric light installations by gas. Then we come to church lighting. The lighting of All Saints' Church, Newmarket, for the quarter ending March 31, 1902, with flat-flame burners, cost £12 17s. 3d.; for the quarter ending March 31, 1903, with incandescent burners, it cost £2 10s. 1d., besides having twice the light. Twelve months ago, I referred to our success in reducing naphthalene complaints. The changes made in increasing the temperature at the outlet of our condensers to a maximum of 95° and minimum of 85° was satisfactory until June 30. Since that date, from some cause at present not known, the complaints increased rapidly each week until the 31st ult. They numbered 724 for that week alone. For last week, they were 371 only. Why is this so? There is no apparent cause for the sudden drop. I congratulate you that the undertaking is in a very good position; and I hope you have the same confidence in its future as I have. I beg to move that the Directors' report be approved and entered on the minutes.

Dr. SORBY, F.R.S., who seconded the resolution, said that he had paid a certain amount of attention to the question of naphthalene; but the more he investigated the matter, the greater difficulty he found in understanding it.

The motion was carried unanimously; and a dividend was afterwards declared of 5 per cent. for the half year on the "A," "B," and "C" stocks.

A vote of thanks to the Chairman terminated the proceedings.

## PROVINCIAL GAS COMPANIES.

### Dissensions on the Board at East Ardsley.

The proceedings at the last half-yearly meeting of the East Ardsley Gas Company were not as calm and uneventful as is so often the case with such gatherings. The Directors in their report stated that the balance standing to the credit of profit and loss was £716; but after taking into consideration the debit on capital account amounting to £583, which was not available for use until refunded out of new capital to be raised, they thought it more prudent not to recommend the payment of a dividend. From this view, however, one member of the Board (Mr. A. F. Goodson, of Heckmondwike) dissented; and he adopted the strong course of sending out a circular to the shareholders asking for proxies. In the course of this, he said: "Now is the time to strike a decisive blow for your own true interests; for, depend upon it, if you let this occasion go by, the case may be hopeless for years, and half year after half year, under some excuse, plausible or otherwise, you will be asked time after time to delay any declaration of dividend. As one who has stood by you in the darkest hours of our history, often single-handed, and often with little help, I claim your support and assistance in this my struggle for the adoption of a reasonable and right policy." The proprietors were evidently moved, for they turned up in such numbers that the meeting had to be adjourned from the Company's offices to the Railway Hotel. The Chairman (Mr. R. S. Balden), in moving the adoption of the report, explained that the Royal Assent had been given to the Company's Bill, so that their capital was now on a legal basis. They were authorized to raise, when required, a further sum of £12,000; and beyond this they could raise on debenture or loan £6150. The share capital already issued amounted to £12,000, and they had borrowed on mortgage £1850, which made their capital stand at £13,850. Up to the end of last December, they had spent £13,442 on capital account. They had since expended £650 in promoting their Bill; and other items brought the total up to £14,433. They had thus had to spend out of revenue on capital account £583. In not recommending a dividend, he held that the majority of the Directors were adopting an absolutely correct policy, in the interests of good finance. Mr. Goodson had taken a most unusual course for a Director in issuing a circular criticizing the actions of his colleagues; he being the only Director to object to the report. The proper way would have been for him to retire from the Board when he found he could not work with the majority. The motion having been seconded, there was some skilful manœuvring for position. Mr. Goodson wished to hear what another member of the Board (Mr. Tweedale) had to say before putting his amendment; but the Chairman threatened to close the debate by putting the motion to the meeting, if Mr. Goodson refused to make his remarks at that stage. Mr. Goodson protested that this "put him in a corner," and that the Chairman had "taken the wind out of his sails" by compelling him to speak first. He, however, proceeded to move, as an amendment, that a dividend be paid at the rate of 4 per cent. per annum. He held that they could pay a dividend—continuously pay a dividend. At the meeting of Directors, he asked for a dividend of 2½ per cent. only; but they would not accept that proposal, so he now went in for the whole hog. The matter resolved itself into a question of the £3000 extra capital they were going to issue. If the Chairman was frightened, he (Mr. Goodson) would take up £1000 that very minute, and would undertake to find someone else to take up the remainder at par. He thought the Directors were treating the shareholders very unfairly, for every half year it was a case of hope deferred. Mr. Tweedale said they could not both eat their cake and have it. For the time being most of the balance of £716 had been spent on capital account; and to pay a dividend before they raised the new capital would simply mean doing so out of borrowed money. Upon a show of hands, six voted for the amendment, and thirteen against. The proxies were then examined, when twenty shareholders (representing £2657) voted with Mr. Goodson, and eighteen (representing £1943) with the Directors. Mr. Tweedale gave his £2000 to the latter; and the Chairman declared the amendment lost. The report was then adopted. An extraordinary meeting was then held, when the Directors were empowered to raise additional capital to the extent of £3000 by the issue of preference shares or stock bearing interest at 5 per cent.

### A Big Increase at Southend.

Mr. C. F. Woosnam, the Chairman of the Southend Gas Company, had a pleasant task when moving the adoption of the report and accounts at the half-yearly meeting last week. He had to announce that, in spite of the mildness of the first months of this year, their business went on steadily increasing. They had 5616 customers—an increase in the half year of 710; and they had in the same time fixed 917 new cookers. They had sold 11 million cubic feet more gas than in the corresponding period of last year, or an increase of 14·36 per cent. This big increase was very largely due to the introduction of gas-cookers and slot meters. They had 526 new slot consumers alone. There had been spent on new buildings, plant, and machinery £3808, and on additional mains, pipes, and other works for distribution £4040. This included 2511 yards of new mains. Additional meters and new gas-stoves and fixing cost £5546; and on the other side they had raised debenture stock £5460. The residual products were good; they had recovered more, and had got better prices for both liquor and tar. This made a difference of about £1000. The total profit for the half year was £4770, which, added to the balance carried forward from the previous six months, left an amount available for dividend of £5268. The report was adopted; and a dividend at the rate of 5½ per cent. was declared.

### A Good Report at Tonbridge.

At the meeting of the Tonbridge Gas Company recently, the Chairman (Mr. W. Judd) congratulated the shareholders on the very favourable report. A better one, he said, had never been presented. After paying all expenses, they had a profit of £2455, and carried forward nearly £1000 after paying the dividend. The consumption of gas continued to increase, notwithstanding the competition of the electric light. The machinery for unloading coal from barges and

conveying it into the stores, which had been erected, was working most satisfactorily, and effecting a great saving in cost. Plant had also been erected for the manufacture of sulphate of ammonia from the gas liquor, which would realize an extra profit of at least £100 per annum. The coal contract, which was always a most important matter, had been arranged on very favourable terms. The Directors had the question of the reduction of the price of gas constantly before them, and were giving it their careful attention. They had every reason to face the future with the utmost confidence. The loan at their bankers had been repaid by the issue of debenture stock, which, considering the state of the Money Market, had been very satisfactory; the price realized being just above par. The Company had entered into a contract with the Urban District Council to fit the public lamps with incandescent burners and to take over the entire charge. The report was adopted; and dividends were declared at the rates of 11½, 8½, and 5 per cent. per annum on the several stocks. The "Tonbridge Free Press," referring to the Gas Company and the local electric light installation, points out that by a strange coincidence the increased amount of profit carried forward by the Company, after paying dividends, is "almost exactly the same as the deficit charged against the rates by the Electric Light Committee."

### An All-Round Improvement at High Wycombe.

Mr. George Wheeler, the Chairman of the High Wycombe Gas Company, stated at the half-yearly meeting on Tuesday that, comparing the balance-sheet with the corresponding one of last year, the capital account had been reduced, owing to £285 having been paid out of revenue for depreciation of the gas stoves and fittings. The expenditure on revenue account showed that £267 less had been paid for coals; but £311 more was spent on repair of works, due to purchasing a larger sulphate saturator, draining board, &c., the thoroughly overhauling and painting of the gasholders, and other minor repairs. The receipts were very gratifying all round. The sales of gas had increased by 1,159,200 cubic feet, and £280 more was received. The revenue derived from residuals also showed an increase of £329; the amount from sulphate alone being £140 more. With meter-rents, &c., the profit showed an increase of £695. He was glad to say that coke was commanding a little better price. Coming to the working results, the make per ton of coal equalled 10,500 cubic feet, against 10,000 feet. The gas made increased by 544,000 cubic feet, and the leakage decreased by 993,000 feet, equal to 4·07 per cent.; and, though the percentage was still high, he hoped they would be able to further reduce it during this half year. Dividends at the rate of 7½ per cent. per annum on the original capital and 5¼ per cent. on the additional capital were declared; and a bonus was voted to the Secretary and Manager (Mr. Harold Baker), as an acknowledgment of extra services rendered by him.

## HARROW AND STANMORE GAS COMPANY.

### A Definite Turning-Point in Prosperity.

The Half-Yearly Meeting of this Company was held on Wednesday, at the Albion Tavern, Aldersgate Street.—Mr. CHARLES HORSLEY, J.P., in the chair.

The ENGINEER AND SECRETARY (Mr. J. L. Chapman) read the notice calling the meeting; and the report and accounts were taken as read.

The CHAIRMAN, in moving their adoption, said there were several items in them which were particularly good. In the first place, the report stated that the Bill promoted in the past session of Parliament had received the Royal Assent. This was very satisfactory to the Board; and so were the powers included in the Bill. The Bill gave them authority to take further land, and also the money powers required for this and the other purposes of the undertaking. He was certain that the shareholders would find the money when it was needed. The Directors also had pleasure in reporting that the increase in the business, together with the improved working since the erection of the new retort-settings and machinery, enabled them to advise the payment of the statutory dividends and a reduction of 2d. per 1000 cubic feet in the price of gas from Michaelmas next. The Board thought it was wise, when they were paying the statutory dividends for the first time, that they should also give the consumers the benefit of a reduction. At an extraordinary meeting to be held at the close of the present one, the shareholders would be asked to authorize the Directors to issue £30,000 of additional capital, and to borrow on mortgage, or by the creation of debenture stock, £10,000 in respect of such additional capital, in manner and at such times as they might deem desirable. As to the accounts, the balance of profit and loss was £5293, from which the Directors recommended the payment of the statutory dividends at the rate of £9 5s. per cent. per annum on the original "A" capital, of 7 per cent. on the additional "B" capital, and of £6 9s 6d. per cent. on the additional "C" capital and guaranteed shares, all less income-tax. Comparing the working and the results with the corresponding half of 1902, he said the gas-rental amounted to £9977, which was an increase of £1252. The sale of gas over the whole district had increased by 5,743,000 cubic feet, or 14 19 per cent. The coke receipts amounted to £1083, which was an increase of £299; this being due to the decreased percentage of fuel used in the new furnaces. There had also been a moderate increase in the tar receipts, and a small decrease in those for sulphate of ammonia —the latter being due to alterations in the washer and scrubber. The total receipts for the half year amounted to £12,173, which was an advance of £1666. The total expenditure for the half year was £7953, which was an increase of £660. Coal had cost more by £283; and there had been an increase of 556 tons in the quantity carbonized. The greater part of the remainder of the extra expenditure had been spent on repairs of works, stoves, and meters. Rates and taxes were also £132 more; there having been lately a fresh assessment over the whole of the Company's district. The profit for the half year was £4219, or an increase of £1006. The make of gas amounted to 49,350,000 cubic feet; and the leakage on the half year was 4·88 per cent., which was very moderate. The production per ton of coal carbonized was 10,567 cubic feet; and the oil used per 1000 cubic feet was 3·12 gallons. During the half year, 92 new ordinary services had been fixed, and 125 new prepayment services.

Mr. A. H. BAYNES, who seconded the motion, described the report as the most satisfactory one ever presented to the shareholders.

Mr. D. HILL remarked that at the last meeting he was taken severely to task by Mr. Randall for having stated that the capital was out of all proportion to the make of gas. Mr. Randall said he was altogether wrong, and advised him to consult the Board of Trade returns. He had done so, and found that he had stated the case quite fairly. He saw that the average capital of similar works—taking about 20—was £725 per million cubic feet, while this Company was then about £1300; but he was pleased to see that this half year it had been reduced to about £1200. The Company had no reserve; and he did not think they wrote off sufficient for repairs and depreciation.

The CHAIRMAN, in reply, said the Board knew the capital was large; and they were sorry for it. But they had never been in a position to get it reduced very much. Now they were doing better, they would keep this matter well before them, and try to get the capital down to a proper level. He did not think they would get as low as £750 per million; but they would try to get down to £1000.

The dividends referred to in the Chairman's speech were declared.

An Extraordinary Meeting was then held, at which the CHAIRMAN moved, and Mr. BAYNES seconded, a resolution authorizing the issue of £30,000 of additional capital, and the borrowing on mortgage, or by the creation of debenture stock, of £10,000. The Chairman mentioned that this was part of the money for which they obtained powers under their new Act, and which they believed would last them a good many years. The Board wished to keep the capital down; but at the same time the Directors desired to work consistently with their obligations. Replying to questions, he stated that, although they had already purchased land, there was an additional piece that they wished to acquire. There were also further extensions of works and mains to be made. It was intended to issue immediately about £6000; and this was chiefly required to pay off their bankers.

The resolution was unanimously carried.

The CHAIRMAN, in moving a vote of thanks to Mr. Chapman, referred to the heavy work he had had recently in connection with the extension and rebuilding of the works and the passing of the Bill through Parliament. In connection with the latter, they had had a great many local authorities to deal with; and it was largely due to Mr. Chapman that the Bill went through unopposed.

Mr. A. F. PHILLIPS, in seconding, assured the shareholders that the Directors had made up their minds that no money but what was absolutely necessary should be spent on the works; and they would take every possible step to bring the capital down. This was a matter that would be considered before any further increase of the dividend.

The motion was heartily passed.

Mr. CHAPMAN, in reply, said they had had days of depression in times gone by; but he was pleased to think they were now passing away. The Company had a very extended district; and, in the early days, they thought it wise to lay pipes wherever they could get customers, with the result that the mains were often long, and the consumers few. This, as well as the buying up of two concerns, accounted for their large capital. He referred to the many indications of growth in the district; and also expressed regret that the Company's old friend Mr. James Glaisher was not with them to see these better times. He recognized, too, the conciliatory attitude of the officers of the local authorities in connection with the Company's Bill.

Mr. JAMES RANDALL moved a vote of thanks to the Chairman and Directors; and, in doing so, reminded Mr. Hill that, in referring him, at the last meeting, to the Board of Trade returns, he stated that in all cases the comparisons as to capital per million cubic feet of gas must be qualified by taking into consideration the character of the districts supplied.

Mr. SAMUEL CUTLER seconded the motion. He thought the shareholders must all regard the accounts with satisfaction, seeing that they had made upwards of £1000 more profit, and had realized an increase of above 14 per cent. in their sales of gas.

The motion was cordially agreed to.

A brief response by the Chairman concluded the proceedings.

**Reductions in Price.**—At the last meeting of the Sutton-in-Ashfield Urban District Council, the Chairman congratulated the members on the success of the gas undertaking, and announced a reduction of 3d. per 1000 cubic feet in the price of gas to all ordinary consumers within the parish. After the 29th inst., the prices will therefore be 2s. 9d., 2s. 11d., and 3s. 1d. per 1000 cubic feet. The Radcliffe and Pilkington Gas Company have announced a reduction in the price of gas, to take effect at the end of the current quarter. It will then be from 2s. 11d. to 3s. 3d. per 1000 cubic feet. The Company have also reduced the price of gas for gas-engines to 2s. 6d. per 1000 feet.

**Colliery Managers and Gas Coal Contracts.**—At the meeting of the National Association of Colliery Managers at Leeds last week, the President (Mr. Walter Hargreaves) delivered an address, in the course of which he dealt with the question of unfair trading—taking the gas coal business as an illustration. He said that the drop in prices in this important section of their trade had been more pronounced than any other, and there was no doubt that to-day's gas coal prices were distinctly unremunerative to the coalowner. Why was this? One of the principal reasons was municipal trading, and the tricky way in which the buying was done. He thought that in the case of gas coal the chances of making fair contracts were all on the side of the coal-owner; and if he and his representatives were not smart enough commercially to hold their own against the corporation buyer, how could he expect the miner to help him to bear the losses which were brought about through the lack of ordinary organizing ability? If ever anything was tried in the way of combination of owners and workmen for the purpose of keeping up prices, he commended the gas coal trade as one, *par excellence*, to which they might devote their attention.

## ATTACKING THE PUBLIC LIGHTING QUESTION AT READING.

### A Useful Report by the Gas Engineer.

The recent references to the keen contest now proceeding at Reading between electricity and gas for the favour of the municipal authority will have aroused interest in the issue; and therefore no excuse need be made for showing what the Gas Company are doing in order, if prepossession for electricity does not rule the decision, to win the whole of the lighting of the streets. A comprehensive report dealing with the subject generally and submitting alternative schemes for the tramway routes and a single scheme for the other parts of the borough has been presented to the Directors by their Engineer (Mr. Douglas H. Helps); and this report is of such a character that the Directors have very wisely sent it intact to the members of the Council, with a covering letter by the Secretary (Mr. Arthur H. Cane). Care and completeness run through the document; and therefore we have pleasure in submitting some of the main parts to our readers—the impression being that it will be found useful to other managers when called upon to look closely into the question.

The details of the schemes for the tramway routes cannot be stated here, as they vary somewhat for every section, but the figures as to costs may be given, and throughout on the tram routes the references to burners may be taken to apply to No. 4 Kerns. The cost tables are as follows :—

*Present System of Lighting Tram Routes.*

| | |
|---|---|
| Annual cost of maintenance | £886 |
| Illuminating Power | 4165 candles. |

(This does not include interest on capital outlay for existing columns, &c.)

*Scheme No. 1 (Tram Routes).*

| | |
|---|---|
| Annual cost for maintenance only, if burners are alight all night | £1540 |
| Annual cost for maintenance only, if triplex and duplex burners be reduced to one burner at 12 o'clock | 1486 |
| Initial cost* | 1693 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost) if burners are alight all night | 1684 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost), if triplex and duplex burners be reduced to one burner at 12 o'clock | 1630 |
| Total illuminating power | 48,110 candles. |

*Scheme No. 2. (Tram Routes.)*

| | |
|---|---|
| Annual cost for maintenance only, if burners are alight all night | £2001 |
| Annual cost for maintenance only, if triplex and duplex burners be reduced to one burner at 12 o'clock | 1841 |
| Initial cost* | 2117 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost), if burners are alight all night | 2181 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost), if triplex and duplex burners be reduced to one burner at 12 o'clock | 2021 |
| Total illuminating power | 64,090 candles. |

* Does not include cost of reinstating service trenches by Corporation. This should not, however, amount to more than £350; and the value of the columns and lanterns displaced will almost balance this figure.

If scheme No. 1 is adopted, it will be seen that the increased annual cost for lighting the tramway routes will be £654; but the candle power will, however, be increased nearly twelve times. If scheme No 2 be adopted, and all burners are kept alight all night, the annual cost will be increased from £886 to £2001, and the candle power increased nearly sixteen times. It will be noticed that there is very little saving to be derived by turning out some of the burners at 12 o'clock at night, as the saving in the consumption of gas is almost equalized by the cost of labour in doing so. In order to arrive at the total annual cost, Mr. Helps has added 3½ per cent. for interest on the initial capital outlay, and 5 per cent. for depreciation of plant, to the annual cost for maintenance; the cost for repairs having been included in the latter figure. Under scheme No. 1, columns and lanterns to the value of £204 will be displaced, and under scheme No. 2 to the value of £275. These amounts have not been deducted from the initial cost. The columns can, however, be utilized on portions of the tramway routes and the lanterns in the outlying streets of the district.

The report proceeds: I have given very careful attention to the lighting of those portions of the tram routes where centre poles exist, as it is most important that the position of these poles should be clearly defined at night time. No provision for any very high candle-power lamps has been made in either of the above schemes, as I am of opinion that a street lighted by means of lamps of medium candle power, placed sufficiently near to one another so that the light from one reaches that from the other, is much more effectually illuminated than one lighted by means of high-candle-power lamps placed farther apart, and drivers of vehicles always prefer the former mode of lighting. If, however, high-candle-power lamps are demanded, there are several forms of high-pressure gas-burners giving lights from 600 to 1000 candle power at a cost, light for light, far below that of the electric arc. Here I should like to quote "The Times" description of the lighting of the Glasgow Exhibition: "The opportunity has been taken to initiate a practical and interesting comparison between the most modern systems of lighting; and there is no doubt that electricity is quite eclipsed by compressed incandescent gas." The "Pall Mall Gazette" bore similar witness in its leading article for Oct. 6, 1902.

It is well known that the electric light has nothing like so high a diffusive power as gaslight; and this is particularly noticeable in foggy weather when the maximum amount of artificial light is required. The well-known chemist, Mr. L. F. Vernon Harcourt, writing to "The Times" last year, thus described his experience during the foggy weather in London: "The arc lights near University College gave a brilliant light close to the high standards; but midway between the standards the lights were entirely obliterated by the fog. Farther on, the double incandescent gas-lights, being much lower and nearer together than the arc lights, were never lost sight of, and afforded as good a light as could be expected under such unfavourable conditions." I should also like to refer to the fact that gas is much more trustworthy. It is quite easy to recall many failures of the electric light in various parts of the country.

My estimate for lighting the town with incandescent gas-burners appears to be high as compared with the cost of the present system—viz., by means of flat-flame burners. In most towns, however, where the flat-flame burner has been in use, the consumption of gas was regulated to 5 cubic feet per hour per lamp. In such cases, when it is decided to substitute the incandescent system, it is possible to do so, and make but a very little—if any—increase in the amount charged per lamp, as the saving in the consumption of gas by such a change goes to pay for the extra cost for the maintenance of the incandescent burners. In Reading, however, seeing that the streets are so ineffectively lighted, the consumption in the flat-flame burners being regulated to only 3½ cubic feet per hour, there will be little—if any—saving in the consumption of gas if the incandescent burner is adopted, though the illuminating power radiated by the lamps will be enormously increased, as has been shown. It must also be remembered that, under the existing arrangement, the consumption of gas is gradually reduced during the evening; so that, by the time the lights in the shops are turned out, the streets are very badly lighted.

In reference to what has been done in other towns, on the 13th inst. I visited Hull, and spent the evening inspecting the street lighting there. In this town notwithstanding the fact that the Municipality generates its own electricity, and has to purchase gas from a local Gas Company, the streets and tramway routes are all (with one slight exception) lighted by means of incandescent gas-lamps. The exception to which I refer occurs in a portion of one of the principal thoroughfares, where twelve so-called 1000-candle power electric arc lamps have been erected. The remainder of this long thoroughfare is lighted by means of clusters of incandescent "C" burners (five in a cluster), placed 60 to 70 yards apart. I took up a position in the middle of this road at a point where the two systems join one another; and I can say, with the greatest confidence, that the lighting of the road and pathway in the direction of the gas-lamps was quite as good as—if not better than—on the line of the electric light. I then measured 100 yards in both directions, and also counted the number of lamps in each case. In one direction, there were four clusters of five "C" burners giving an actual light of not less than 1480 candles, at a cost of £33 per annum; and in the other direction, four so-called 1000-candle power arc lamps, the charge for which is £80 per annum—a most striking example of the difference between illuminating power and illuminating effect. It was a dark night when I was in Hull, yet while standing in the middle of the road lighted by means of the gas-burners, I could clearly distinguish the tram lines for fully 400 yards. The lighting was very uniform and devoid of shadows in the road and pathway.

It certainly does strike one as being somewhat remarkable that the authorities in Reading should hesitate whether to light the streets by means of incandescent gas or electricity, seeing that, if the latter system is adopted, electricity will have to be purchased from a private Company; whereas in Hull, Liverpool, and other towns, the Municipalities have proved that it is much cheaper to purchase gas fom the local Gas Companies rather than to take electricity from their own works to light the streets. So recently as Aug. 24 last, the "Daily Telegraph," in an interesting article on the use of gas, wrote as follows: "It is worthy of note that the Borough Councils of Poplar, Stepney, and West Ham have accepted an offer from the Commercial Gas Company for public lighting by means of incandescent burners; these public bodies having, after extensive inquiry, come to the conclusion that this means of lighting the streets is cheaper than electricity, and quite as satisfactory." I may add that many other London Councils have settled this question in favour of gas, notably in the case of Islington. Alderman Petrie, Ex-Lord Mayor and a member of the Gas and Electricity Committee of Liverpool, recently said that he was convinced that electricity was much more costly than gas for street lighting, and stated only some few months ago that to introduce electricity for public lamps in all the streets would enormously increase the lighting rate. He instanced two streets, one of which is electrically lighted at a cost of £491 per mile, while the other is better lighted by means of incandescent gas at a cost of £283 per mile.

This question is not in the experimental stage. Wherever the two systems have been tried side by side, it has almost invariably been settled in favour of gas. I have referred to Islington. At a meeting of the Borough Council there in July last, the Lighting Committee recommended that no further steps should be taken for the extension of arc lighting; and Mr. Lemon, one of the members of the Council, stated that, when the whole of the facts were put before the Council and the ratepayers, it would be a question whether they should not abandon electricity altogether for public lighting, and adopt incandescent gas for the whole borough. The Committee's recommendation was adopted. I am yet again tempted to quote some remarks recently made by Mr. J. T. R. Wilson, who is a member of the Gas Commission and also of the Electric Lighting Committee of Edinburgh. Mr. Wilson, having given some comparative figures of the cost of the two systems, said: "I need not now emphasize further the enormous advantages of incandescent gas for street lighting. It may be pointed out that, although the electric arc lamp may give a light of 500 candle power, and 3½ incandescent lamps only 350 candles, yet, owing to the great height of the electric light from the ground and the efficient reflectors in incandescent lanterns, as much light is actually thrown on the ground by the cheap incandescent light as by the enormously costly electric light. I am convinced that electric street lighting by means of arc lamps is out of date."

I have made the above remarks and given these quotations of the opinions of others before describing my proposed scheme for the lighting of the streets other than the tramway routes, as they (the remarks) apply more particularly to the lighting of these routes.

*Lighting of Thoroughfares other than Tramway Routes.*

Mr. Helps here specified a number of streets which he proposes to light with No. 4 Kern burners, to be placed in new lanterns on the

existing columns. There are 227 lamps to be converted in these streets, and 15 3-light clusters would also be fitted in the large lamps.

| | |
|---|---|
| Annual cost for maintaining these lamps, if burners are alight all night | £851 |
| Annual cost for maintaining these lamps, if triplex and duplex burners be reduced to one burner at 12 o'clock | 829 |
| Initial cost | 481 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost), if burners are alight all night | 891 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost), if triplex and duplex burners be reduced to one burner at 12 o'clock | 870 |

The remainder of the lamps in the borough, to the number of 893, he proposes to fit with No. 3 Kern burners; the existing lanterns being used. Three 3-light clusters would also be placed in the existing large lamps, and eleven special lanterns required at certain other points.

| | |
|---|---|
| Annual cost for maintaining these lamps, if burners are alight all night | £2442 |
| Annual cost for maintaining these lamps, if triplex and duplex burners be reduced to one burner at 12 o'clock | 2439 |
| Initial cost | 403 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost), if burners are alight all night | 2478 |
| Total annual cost (including cost of maintenance, *plus* 8½ per cent. on initial cost), if triplex and duplex burners be reduced to one burner at 12 o'clock | 2473 |

Summing up, Mr. Helps says: It will be seen that the present cost of lighting the borough amounts to £4187 per annum, with an illuminating power equal to 22,965 candles. If scheme No. 1 (on tram route) is adopted, the total cost, including interest and depreciation, will amount to £5053 per annum, if all the burners are kept alight throughout the lighting hours, and to £4973 if the triplex and duplex burners are reduced to one burner at 12 o'clock at night. The candle power will, however, be increased from 22,965 candles under the present system to 138,670 candles. If scheme No. 2 (on tram route) is adopted, the total costs will amount to £5550 per annum with all the burners alight, and to £5364 with the cluster lights reduced to one burner at 12 o'clock, and the illuminating power will be raised to 154,650 candles.

[The report is accompanied by drawings and other tables.]

## THE PUBLIC LIGHTING OF NEWPORT.

A short discussion took place at the Monthly Meeting of the Newport Corporation last Tuesday with regard to the decision arrived at by the Lighting Committee to increase the number of arc lamps in the town. Already the Corporation have 76 arc lamps; and the Committee propose to erect another 68, making a total of 144. A further reference to the matter appears in another part of to-day's "JOURNAL" (p. 668). The Gas Company offered to put up in place of the existing electric lamps, and covering the ground to be taken up by the new ones, 144 triple self-intensifying Welsbach incandescent gas-lamps. The cost of the electric light installation is given at £6700; while the one for gas was offered at £2448. In the case of electricity, the annual cost of current, upkeep, interest, and sinking fund works out to £2706; whereas for gas the same items would come to £1875—or a difference in favour of the latter of £831 a year. Besides this, the illuminating power of each of the gas-lamps would be 1050 candles, which makes them superior to their rivals. These figures no doubt puzzled Mr. Moxon, who inquired what had induced the Lighting Committee to refuse the offer of the Gas Company to supply triple Welsbach lamps, if such lighting was cheaper than the increased number of arcs were likely to be. Alderman Moses replied to this question by asking several others. "Was it likely," he said, "that after giving the town the illumination they now had from electricity, the Committee could recommend a return to gas. The Council would never accept for a moment a recommendation of the Committee to go back to the Dark Ages. It was true the Gas Company had improved the gas lighting; but what had caused them to do it? Again, if the Company could give the Corporation the benefit of cheaper lighting than electricity could, why did they not give it to the consumers?" Alderman Canning said he did not wish to intervene; but he hoped Alderman Moses did not suggest that electric lighting was cheaper than gas. The report of the Committee was then adopted.

## GLASGOW CORPORATION GAS SUPPLY.

### The Report of the Gas Committee.

The Committee on Gas Supply of the Glasgow Corporation have issued their thirty-fourth annual report and balance-sheet of the undertaking, which deals with the year to May 31. The report states:

The gross revenue amounts to £885,414, and the gross expenditure to £684,065, to which is added £50,037 depreciation written off capital assets—making £734,102; the balance carried to profit and loss account being £151,312. The Committee had to meet the following requirements during the year: (1) Annuities on stocks, so far as unredeemed or unconverted, £25,430; (2) contribution to Corporation loans fund in respect of £269,493 3 per cent. Corporation stock, redeemable 1921, £8134; (3) interest on borrowed money and redeemed loans, &c., £52,445; and (4) sinking fund, £17,198—a total of £103,207; leaving a surplus on the year's operations of £48,105. Out of this, the Committee have met: The balance at the debit of last year's account of £15,085; the loss on the electricity account for year ending May 31 last, of £13,895; and have applied the balance in reducing the amount at the debit of the premium account in respect of the gas annuity stocks converted as at May 31, by the issue of the Corporation redeemable stock above referred to, £19,124—in all, £48,105.

In order to maintain the undertaking in its present favourable position, the Committee, taking advantage of the present state of the finances, have transferred from revenue to capital in name of depreciation on the undernoted works, in addition to the usual amounts written off, the following sums—viz.: On old Kilpatrick station and works, £3067; on Pollokshaws station and works, £1644; and on Milngavie station and works, £1335.

The average price received for tar and liquor per ton of coal carbonized was 4s. 5·106d., as compared with 2s. 11·38d. for the previous year; being an increase of 1s. 5·725d. per ton. The quantity of coke sold was 281,148 tons, as compared with 277,430 tons for the previous year; being an increase of 3718 tons. The average price received was 5s. 5·28d. per ton, as compared with 5s. 3·43d. for the previous year—an increase of 1·83d. per ton.

The Committee have applied £104,816 of the sinking fund to the extinction of £21,609 of 9 per cent., and £10,320 of 6¾ per cent. annuity stocks; so that the annuities formerly payable upon these stocks now cease to be a charge upon the revenue of the department. During the year, £58,227 of 9 per cent., and £28,805 of 6¾ per cent. gas annuity stocks have been cancelled, the loans fund issuing in substitution therefor to the holders of these annuities, £269,493 of 3 per cent. Corporation stock, redeemable in 1921. The sinking fund, with its accumulations, now stands at £463,896.

Having regard to the favourable result of the year's operations recorded above, and to the decreased price at which coal required during next year has been purchased, the Committee feel they are justified in recommending that the price of gas for lighting purposes should be 2s. 2d. per 1000 cubic feet, a reduction of 2d. per 1000 cubic feet; motive power, 1s. 10d. per 1000 cubic feet; and within the additional area of the gas supply referred to in the Glasgow Corporation (Gas, &c.) Order, 1902, the charge for gas for (*a*) lighting purposes should be 3s. 2d. per 1000 cubic feet, and for (*b*) motive power purposes, 2s. 10d. per 1000 cubic feet—being also a reduction of 2d. per 1000 cubic feet. The reductions now recommended will take effect respectively as from the date of the last survey.

The works and mains have been maintained in a state of efficiency during the year. The equipment of the new works at Provan is well advanced. The most important parts of the apparatus have been erected, and the work of connecting the separate plant is being pushed forward. The first gasholder is expected to be finished by the end of October next. The tar distilling and sulphate of ammonia plant in connection with Provan works is in course of erection; but it is doubtful if it will be ready in time for this winter.

About 28 miles of new mains were laid last year. The number of meters in use on May 31 was 216,122—an increase of 6365 over the same date in 1902. During the year, 21,100 meters were repaired, and 23,088 were examined while in use, of which 20,760 were found in a satisfactory condition, and 2328 were found defective and removed. The number of gas-stoves on hire at May 31 was 23,851. The number of gas heating and cooking appliances sold during the year was 1763.

## INSTRUCTIONS AS TO PROVISIONAL ORDERS.

Circulars and instructions regarding Provisional Orders under the Public Health Act, 1875, the Local Government Act, 1888, and the Gas and Water Works Facilities Acts have been issued by the Local Government Board to Metropolitan Borough Councils, Town Councils, Urban District Councils, and Rural District Councils. The circulars are almost identical in terms, but variations are made in the case of different authorities.

The circular addressed to District Councils state that the Board deem it desirable to follow the practice of previous years, and to fix a day before which all applications for Provisional Orders under the Public Health Act, 1875, must be made, if it is wished that the Order should be confirmed during the session of 1904. The necessity for this course is the more apparent in view of the Standing Order 193A of the House of Commons, which provides that no Bill originating in that House for confirming a Provisional Order shall be read the first time after Whitsuntide. The experience of recent years shows that, unless this date is strictly adhered to, it will probably be impossible for Bills to confirm Provisional Orders which are not introduced into the House of Commons before the Whitsuntide recess to reach the House of Lords by the date necessary to ensure compliance with the Lords' Sessional Order relating to the second reading of such Bills. The Board have accordingly determined that all such applications must be received by them not later than the dates mentioned in the Provisional Order instructions; and it must be clearly understood that those dates are fixed as the latest at which applications for Provisional Orders can be received. It is obviously desirable that, wherever practicable, the applications should be made earlier; and the Board therefore trust that District Councils (or other authorities) who may propose to apply for Provisional Orders will make their applications as soon as they are in a position to furnish the requisite particulars. It is particularly important that applications for Provisional Orders to alter Local Acts should be made at the earliest possible date. These applications often require much consideration; and the Board are able to give more attention to them in the autumn than is possible during the earlier part of the following year.

The Board have carefully revised the instructions which they have been accustomed to issue relating to applications for Provisional Orders under the Public Health Act, 1875. If the District Council propose to apply for a Provisional Order for gas purposes under the Gas and Water Works Facilities Acts, the special regulations which have been issued by the Board under those Acts, copies of which can be obtained on application, must be complied with.

In connection with applications for the sanction by the Board of the costs incurred by a District Council in promoting or opposing a Provisional Order, under section 298 of the Public Health Act, 1875, it is the practice of the Board to require that such costs shall be taxed by the taxing officer of one of the Houses of Parliament. It will not, therefore, be necessary to submit such costs for taxation by the Clerk of the Peace.

## OPENING OF NEW MUNICIPAL GAS-WORKS AT SOUTHMOLTON.

### An Interesting Ceremony—Mr. Willey on Fiscal Reform.

Last Saturday week, the Mayor (Mr. Fred Day), in the presence of members of the Town Council and a number of the inhabitants, formally turned gas into the new gasholder which has been erected as part of the extension scheme in connection with the gas-works. On the party assembling,

Mr. H. A. WILLEY, of Exeter, said that, as Engineer to the Council, it was his pleasing duty to ask the Mayor to turn the gas into the new holder for the first time for the use of the town. He was glad to say that the work had been carried out by a firm of excellent repute, in a manner in every sense of the word creditable to them, and in a way that he hoped in the future would be of great advantage to the town. He supposed they might consider themselves as engaged in the work of gas manufacture, and that they were independent of all other circumstances outside for the time; so that it might be wise for a moment to consider what the possible effect would be upon gas undertakings if any question of fiscal reform were introduced as affecting the commerce of the country and affecting more particularly those who were engaged as gas administrators, and who had works of the character of those before him under their charge. They had, happily, in England an inexhaustible supply of coal; so that they would not require, for the main purpose of gas manufacture, to import from abroad any coal which would materially affect, by increased prices, the method and the result of making gas. He had, himself, taken a strong line in the direction of some method of inquiry and alteration of the present system of fiscal reform, because, with the competition of the electric light and the competition of oil, he felt that the ultimate destiny—the successful working of all gas properties—lay in the direction, absolutely, of the prosperity of the working classes of the country. Gas was essentially a working man's element. The working man required it, and would require it in the future to a much greater extent for purposes of cooking and lighting; and he (Mr. Willey) had felt that, to a large extent, the interests of the working classes and their employment was imperilled under the present system. If the gas companies and gas concerns were going to fight the electric light, it must be by introducing, under the most favourable and economical circumstances, the use of gas into every working man's home. He had been the subject of some criticism in North Devon lately owing to the fact that his firm had opened a branch business in Barnstaple, where they had taken up the electric light hand in hand with gas. Some of his friends seem to have been a little offended at the fact that his firm had issued a circular in which they stated what were the advantages of electric light over gas lighting. He might say that so strong was his faith in the ultimate prosperity of gas undertakings that, so far as his circumstances would allow, he would buy every gas share upon the market in North Devon. It was to some extent upon his recommendation that the Corporation of Southmolton acquired their gas-works. The results, up to the present time, had fully justified the step; and they would, he believed, do so to a greater extent in the future when the Corporation had the means of supplying the inhabitants with a universally admitted excellent method of lighting and heating and power. There were certain people who would have the electric light, no matter what it cost. Should a time arrive when it was thought desirable for Southmolton to introduce the electric light, it would be the simplest thing possible to put down the necessary plant—using gas for producing the electric current, and doing in Southmolton as was done in many parts of the kingdom and Empire—selling to the public whichever they desired, electric light or gas, at an absolute minimum of cost without going to the expense of putting down an electric light station. Many improvements in gas lighting were being introduced. Scarcely a year passed without the finding of some new and improved product in connection with coal, and also in connection with the method of burning and using gas. A way had recently been discovered of inverting the mantles of incandescent gas-burners in such a manner that the effect rivalled even the best electric light. He was very pleased, he continued, to be present and see that the plant at the new gas-works had been all erected so well and so creditably by the firm of contractors whom the Council engaged. He should like to add that he appreciated very highly the valuable services which had been rendered by the Manager of the works (Mr. A. Braddick) and Mr. A. S. Wootton, the Borough Surveyor. It was no small thing to go into gas-works of the size of those around him and turn the place upside down, and yet maintain for the town an adequate supply of gas. This, however, had been done, and no hitch of any kind had occurred, which said a great deal for the man the Council had in charge; and he (Mr. Willey) felt sure the Corporation would appreciate the services which the Manager had rendered. From the Contractors he (the speaker) had received every courtesy. He hoped that the work would prove to be a great benefit to the town. Mr. Willey concluded by asking the Mayor to turn the gas into the holder.

His WORSHIP, having formally turned on the gas, said he was pleased to take part in the present ceremony, which concluded the extension of the gas-works. Some short time since, he attended there to drive the first rivet into the new holder—part of the extensions which were the outcome of the deliberations of the Town Council, who had arrived, after a thorough investigation of the matter, at a determination to develop and enlarge the gas-works in consequence of the increased consumption in the place. The want was one which had certainly been felt in the borough for some time; and he was pleased to state that the matter had now developed and taken shape in a practical form. The new holder was of about the same capacity as the old one; and he was glad to say that, so far as he could gather, the work had been carried out by the contractors in a highly satisfactory manner. Southmolton had always congratulated herself upon having a progressive Council, and he was pleased that in future the inhabitants would have more light thrown on their different pursuits. He hoped it would be found that the policy which the Council entered upon when they decided to carry out certain improvements and extensions of the gas-works, at a cost of about £1600, would meet with the approbation of the town generally. He quite indorsed what Mr. Willey had said with reference to Mr. Braddick, who was not only a most courteous but able Manager. He wished to thank Mr. Willey, on behalf of the Council, most cordially for the efficient manner in which he had performed his part of the work, which, so far as could be gathered, had been brought to a successful termination. He was of opinion that what had been done would meet a genuine want in the borough.

A vote of thanks was accorded the Mayor, and cheers were also given for Mr. Willey, Mr. Braddick, and those engaged in the work. The workmen were subsequently entertained.

## THE COST OF PUBLIC LIGHTING AT ROCHDALE.

### The Rates to Bear It.

The question of who should bear the cost of the public lighting was the subject of an interesting discussion at the last meeting of the Rochdale Town Council. It was raised by Alderman Petrie, who moved the adoption of a recommendation of the Gas and Electricity Committee, that, after the present financial year, the cost of public lighting should be a charge on the rates. The reason the subject was brought forward at the present time was that the whole of the Corporation accounts had been overhauled and revised by an eminent firm of accountants. In their report they made a few recommendations, one of which was that the cost of public lighting after the present financial year should be charged to the rates. That this proposal was correct and equitable, Alderman Petrie did not fear any gentleman would deny, not even those who would prefer to continue under the present system. Three reasons used to be advanced in opposition to the change. The first and main one, he believed, was that they would escape paying a certain amount of income-tax by mixing up the cost of public lighting with the profits of the gas-works, and so making the profits appear less. Whatever might have been the case years ago, however, the present income-tax authorities would not allow the Corporation to make any saving under this head. Another reason advanced was that it was an easy way of raising money. Was that a sufficiently good answer? The third reason, and no doubt the one most relied on, was that the present method got money from people who would otherwise not contribute to the rates. If this were so, did it not, the Alderman asked, imply that there was something radically wrong in the machinery in use for collecting the rates—that the incidence was somewhere unjust, and that something needed reform? He thought it did. But if they were to continue in this course, it was the very way to delay the correction of what was improper in the rating machinery. The way to make a man want to reform anything was to make him suffer under the present *régime*. If the Council adopted the recommendation, the effect would be an addition of 4d. in the pound to the rates. This would be exactly counterbalanced by the increased amount which would go to the profits of the gas-works, and which would be handed over to the satisfaction of the rates, so that there was really no change in the net result. But some gentlemen would say that, if the profits were made as large as that, they would have to lower the price of gas. He denied that. They might do it; but it did not necessarily follow. The profits would not be really larger than before; and as the Council was the authority which could either raise or lower the price, any proposal to change would have to be considered by them.

The motion was seconded by Mr. Sharp, who had come to the conclusion that the change would ultimately mean a permanent reduction in the price of gas. If spared, he hoped to move next year for a reduction in the price if one was not made in the meantime, and to be the means of giving back to the people money which had been taken from them in an indirect way. The gas profits were far too high. They had no right to make gigantic profits to which only those who used gas contributed. He found that many large corporations were being supplied with gas by private companies at a considerably less charge than obtained in Rochdale. Plymouth paid 1s. 9d. per 1000 cubic feet; Sheffield, 1s. 8d. and 2s.; Hull, 2s.; Newcastle, 2s. 1d.; York, 1s. 11d. and 2s. 2d.; and Bristol, 2s. 3d. All these were supplied by private Companies. If the change were made, he took it that the General Purposes Committee would appoint a Sub-Committee to deal with street lighting. It would not tend towards economical working if one Committee spent money which another Committee had to pay. The cost of street lighting was £5600. To find arguments against the proposal, Alderman Cunliffe went back to see what was the nature of those advanced when the present course was adopted. The change would cause an extra burden to fall on the rates of between £5000 and £6000 a year; and it would be seen how this amount might grow. A possible addition of 6d. in the pound to the rates was a very serious question. People seeking to develop new industries in a town did not usually ask "What is the price of gas?" but "How much in the pound are your rates?" The Council had spent money pretty freely this year; and he was afraid they could look forward to no probable reduction in the amount of rating. He thought they should set against the advantage of a more businesslike way of book-keeping, the injustice in respect of high rates. Another class of burgesses who would suffer was the small property owners. The next speaker was Mr. Calvert; and his vision was somewhat clearer than the preceding speaker's on the point of injustice. The injustice was, he said, obviously on those people who had involuntarily to pay far more than their share of the rates. This applied to the manufacturers and shopkeepers, who for the greater part used gas to an enormous extent. It was not businesslike, nor, he thought, strictly legal, to charge the cost of lighting the streets to one of the productive undertakings. The resolution was also supported by Mr. Hoyle, who did not think it would make any difference to the property owners, and believed a reduction in price would increase the demand for gas. Mr. Howarth asked for an assurance from the Chairman of the Committee that the price of gas would be reduced. Mr. Jones thought that next spring would be quite time enough to go into the question of the price. He was rather surprised Alderman Petrie had not referred to the case

of the ratepayer who burned oil in his cottage. That person contributed nothing whatever to the rates in that respect. He walked about the gas-lighted streets, and did not pay a penny towards the cost. It seemed rather "hard lines" that the Corporation should be giving people who used electricity an article at below cost price up to now, and charging another section of the community 25 per cent. profit.

There was nothing for Alderman Petrie to reply to. He, however, expressed his willingness for another Committee to take over the street lighting, but would not give the assurance asked by Mr. Howarth.

The resolution was carried, by eighteen votes to eight.

## PRICE OF GAS AT MIDDLETON.

On the minutes of the Gas and Electricity Committee coming up for confirmation at the monthly meeting of the Middleton Town Council, Mr. Aspell moved, as an amendment, that the minutes pass with the exception of the one relating to the defeat of a resolution to raise the price of gas (except that used in prepayment meters) 3d. per 1000 cubic feet from the commencement of the next quarter; and that the minute be referred back to the Committee for further consideration. He thought something should be done to reduce the debt that was at present standing against them; and there was nothing for it but to raise the price of gas. On the operations of the gas-works last year they had a loss of £700; and he had asked the members of the Gas Committee what reason they had for supposing there would be a very great difference in the working this year. They said they would be able to reduce their coal account; but he was convinced that unless they raised the price of gas they would not be able to lower the debt very much. The suggested increase in the price of gas would realize £650, which could be used to go against the present debt. He hoped the Committee would look the situation in the face. The gas-works revenue account was not in a very satisfactory state at the present time; and the Auditors said it required the serious attention of the Council. Mr. Wade, in seconding the amendment, remarked that the ratepayers ought not to be saddled with a commercial industry that was not paying its way. Mr. Roe said he was one of the members of the Committee who voted against the proposition to advance the price of gas, as it would mean people doing away with their cookers; and the Corporation would defeat their own object and lose by it. The Manager said he could wipe the deficit off without the price being raised. Several other members were of opinion that it would be an unwise step to increase the charge for gas at the present time; and, on being put to the vote, the amendment was lost.

**Metropolitan Water Board.**—The Joint Committee of the Urban District Councils of Hornsey and Wood Green have elected Mr. J. D. Lewis as their representative on the Metropolitan Water Board, in the place of Mr. Henry Bart, who has resigned.

## PARLIAMENTARY COMMITTEE ON MUNICIPAL TRADING.

### Portions of the Evidence Abstracted.

### First Day—June 22.

(*The Earl of* CREWE, *Chairman, Lord* ZOUCHE, *Lord* BARNARD, *Lord* BROUGHAM *and* VAUX, *Lord* ABERDARE, *Lord* LAMINGTON, *Lord* ROTHSCHILD, *Sir* GEORGE BARTLEY, *Sir* JOHN STIRLING-MAXWELL, *Sir* JAMES WOODHOUSE, *and Messrs.* FENWICK, JOYCE, PLATT-HIGGINS, *and* POWELL-WILLIAMS.)

Sir SAMUEL B. PROVIS, K.C.B.,

Permanent Secretary to the Local Government Board.

The first witness to be examined by the Committee was Sir Samuel B. Provis, K.C.B., the Permanent Secretary to the Local Government Board, who furnished figures bringing up to date the statistics he laid before the Joint Committee on Municipal Trading who sat in 1900. With regard to the amounts borrowed by authorities in connection with trading undertakings during the three years 1900-2, he said the Local Government Board had sanctioned loans for water-works amounting to £2,420,000, of which amount £1,389,000 was sanctioned under the general law and £1,031,000 under Local Acts. During the same period, Local Acts authorized the borrowing without sanction from a Government Department of £6,475,000. The loans sanctioned by the Board for gas-works purposes amounted to £1,641,000, of which £81,000 was under the general law and £1,560,000 under Local Acts. The loans authorized by Local Acts without sanction of his Department amounted to £2,053,000. For electric lighting, the loans sanctioned by the Board amounted to £10,226,000, of which £9,367,000 came under the general law and £859,000 under Local Acts. In addition to this, £1,427,000 was raised without sanction under Local Acts. As to the outstanding debt of local authorities, the figures at various periods, for the purposes mentioned above, were: Water-works—1885, £30,326,000; 1898, £47,867,000; and 1901, £56,255,000. Gas-works—1885, £13,768,000; 1898, £18,292,000; and 1901, £20,781,000. Electric lighting—1898, £3,674,000; and 1901, £11,066,000. Total amount of outstanding loans for all purposes—1885, £173,207,000; 1898, £262,017,000; and 1901, £316,704,000, or an increase since 1885 of 82 per cent. The number of Acts obtained by local authorities in 1901 was 74; and in 1902, 57. In the session of 1903, 65 Bills had been promoted, of which, up to that time (June 22), 12 had been either dropped or defeated. Taking the Acts of 1902, 20 were given for water supply. In two cases permission was granted to purchase a water company's undertaking; and in another the unexercised powers of a company were transferred to the local authority. Five Acts related to gas supply; power being given in three cases to acquire a company's undertaking. Thirteen Acts were in respect of electric lighting; and in one instance the purchase of a company had been

## GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

**Referred to on p. 668.**

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | GAS COMPANIES. | | | £ s. d. |
| 590,000 | 10 | April 17 | 10½ | Alliance & Dublin 10 p.c. | 18½—19½ | .. | 5 7 8 |
| 100,000 | 10 | ,, | 7½ | Do. 7 p.c. | 13—14 | .. | 5 7 2 |
| 200,000 | 5 | May 14 | 6½ | Bombay, Ltd. | 5½—6 | .. | 5 8 4 |
| 140,000 | 5 | ,, | 6½ | Do. New, £4 paid | 4—4½ | .. | 5 15 7 |
| 380,000 | Stk. | Aug. 13 | 12 | Brentford Consolidated | 235—240 | .. | 5 0 0 |
| 300,000 | ,, | ,, | 9 | Do. New | 173—178 | .. | 5 1 1 |
| 50,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 130—135 | .. | 3 14 1 |
| 206,250 | ,, | June 11 | 4 | Do. 4 p.c. Deb. | 105—110 | .. | 3 12 9 |
| 220,000 | Stk. | Sept. 11 | 10⅝ | Brighton & Hove Orig. | 207—212* | −5 | 5 0 2 |
| 246,320 | ,, | ,, | 7⅛ | Do. A. Ord. Stk. | 145—150* | −6 | 5 3 4 |
| 460,000 | 20 | Mar. 31 | 10 | British | 39½—40½ | .. | 4 18 9 |
| 100,000 | Stk. | Aug. 13 | 6 | Bromley, Ord. 10 p.c. | 115—120 | .. | 5 0 0 |
| 165,700 | ,, | ,, | 4½ | Do. do. 7 p.c. | 88—93 | .. | 4 16 9 |
| 500,000 | 10 | May 14 | 7 | Buenos Ayres (New) Ltd. | 10⅞—11½ | .. | 6 4 5 |
| 250,000 | Stk. | June 26 | 4 | Do. 4 p.c. Deb. | 93—95 | .. | 4 4 3 |
| 150,000 | 20 | July 10 | 8½ | Cagliari, Ltd. | 22—24 | .. | 6 17 6 |
| 100,000 | 10 | June 11 | 10 | Cape Town & Dis., Ltd. | 14½—15½ | .. | 6 9 0 |
| 50,000 | 50 | May 2 | 6 | Do. 6 p.c. 1st Mort. | 52—54 | .. | 5 11 1 |
| 1,375,000 | Stk. | Aug. 27 | 5 2/10 | Commercial Old Stk. | 105—108 | .. | 4 16 3 |
| 503,750 | ,, | ,, | 5 | Do. New do. | 100—103 | .. | 4 17 1 |
| 442,947 | ,, | June 11 | 3 | Do. 4½ p.c. Deb. do. | 87—90 | .. | 3 6 8 |
| 800,000 | Stk. | June 11 | 7 | Continental Union, Ltd. | 120—125 | .. | 5 12 0 |
| 200,000 | ,, | ,, | 7 | Do. 7 p.c. Pref. | 137—142 | .. | 4 18 7 |
| 575,000 | Stk. | Aug. 27 | 5½ | Crystal Palace Ord. 5 p.c. | 112—117 | .. | 4 11 1 |
| 60,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 118—123 | .. | 4 1 4 |
| 112,533 | ,, | July 10 | 5 | Do. 5 p.c. Deb. Stk. | 135—138 | .. | 3 12 6 |
| 486,090 | 10 | July 29 | 10½ | European, Ltd. | 17½—18½ | .. | 5 13 6 |
| 354,060 | 10 | ,, | 10½ | Do. £7 10s. paid | 12½—13½ | .. | 5 16 8 |
| 15,243,200 | Stk. | Aug. 13 | 4 3/8 | Gas-light and Coke { 4 p.c. Ord. | 85—87 | −2 | 5 1 0 |
| 2,600,000 | ,, | ,, | 3½ | 3½ p.c. max. | 84—86 | +1 | 4 1 5 |
| 3,799,735 | ,, | ,, | 4 | 4 p.c. Con. Pref. | 102—105 | −2 | 3 16 2 |
| 4,193,975 | ,, | June 11 | 3 | 3 p.c. Con. Deb. | 87—89 | .. | 3 7 5 |
| 258,740 | Stk. | Sept. 11 | 5 | Hastings & St. L. 3½ p.c. | 90—95* | .. | 5 5 3 |
| 70,000 | 10 | June 11 | 8 | Hongkong & China, Ltd. | 15—16 | .. | 5 0 0 |
| 3,800,000 | Stk. | May 14 | 10 | Imperial Continental | 200—203 | −2 | 4 18 6 |
| 473,600 | Stk. | Aug. 13 | 3½ | Do. 3½ p.c. Deb. Red. | 99—102 | .. | 3 8 7 |
| 165,242 | Stk. | Aug. 27 | 6 | Lea Bridge Ord. 5 p.c. | 113—118 | .. | 5 1 8 |
| 561,000 | Stk. | ,, | 10 | Liverpool United A | 215—217 | .. | 4 12 2 |
| 718,100 | ,, | ,, | 7 | Do. do. B | 162½—4½ | .. | 4 5 1 |
| 306,083 | ,, | June 26 | 4 | Do. do. Deb. Stk. | 110—112 | .. | 3 11 5 |
| 75,000 | 5 | June 11 | 5 | Malta & Medn., Ltd. | 4½—4⅝ | .. | 5 5 3 |
| 560,000 | 100 | April 1 | 5 | Met. of Melbourne { 5 p.c. Deb. | 103—107 | .. | 4 13 6 |
| 250,000 | 100 | ,, | 4½ | 4½ p.c. Deb. | 102—104 | .. | 4 6 7 |
| 541,920 | 20 | June 11 | 3½ | Monte Video, Ltd. | 9—10 | .. | 7 0 0 |
| 1,515,892 | Stk. | Aug. 13 | 4½ | Newc'tle & G'tesh'd Con. | 103—104 | +½ | 4 6 7 |
| 376,855 | Stk. | July 3 | 3½ | Do. 3½ p.c. Deb. | 98—99 | −1 | 3 10 8 |
| 300,000 | Stk. | May 14 | 8 | Oriental, Ltd. | 140—145 | .. | 5 10 4 |
| 600,000 | 5 | Sept. 11 | 7 | Ottoman, Ltd. | 5⅜—6⅜ | .. | 5 7 8 |
| 205,005 | Stk. | June 26 | 6½ | Ply'mth & St'house 5 p.c | 123—128 | .. | 4 15 8 |
| 851,070 | 10 | April 30 | 7 | River Plate Ord. | 11¼—11¾ | +¼ | 5 19 2 |
| 300,000 | Stk. | June 26 | 4 | Do. 4 p.c. Deb. | 94—96 | .. | 4 3 4 |
| 250,000 | 10 | April 17 | 8 | San Paulo, Ltd. | 11⅞—12⅛ | .. | 6 8 0 |
| 135,000 | Stk. | Mar. 12 | 10 | Sheffield A | 239—241 | .. | 4 3 0 |
| 209,984 | ,, | ,, | 10 | Do. B | 237—240 | .. | 4 3 4 |
| 523,498 | ,, | ,, | 10 | Do. C | 237—239 | .. | 4 3 8 |
| 103,235 | Stk. | Mar. 31 | 5 | Shrewsbury Ord. 5 p.c. | 111—114 | .. | 4 7 9 |
| 6,150,000 | Stk. | Aug. 13 | 5½ | South Met., 4 p.c. Ord. | 119—121 | −1½ | 4 9 4 |
| 1,580,000 | ,, | July 10 | 3 | Do. 3 p.c. Deb. | 87—89 | −1 | 3 7 5 |
| 380,940 | Stk. | May 14 | 5 | Southampton Ord. | 105—110 | .. | 4 10 11 |
| 87,950 | ,, | July 10 | 4 | Do. 4 p.c. Deb. | 102—105 | .. | 3 16 2 |
| 120,000 | Stk. | Aug. 27 | 6 | Tottenham and Edmonton { A. 5 p.c. | 115—120 | .. | 5 0 0 |
| 313,020 | ,, | ,, | 4½ | B. 3½ p.c. | 95—100 | .. | 4 10 0 |
| 182,380 | 10 | June 11 | 8 | Tuscan, Ltd. | 8—9 | .. | 8 17 0 |
| 149,900 | 10 | July 1 | 5 | Do. 5 p.c. Deb. Red. | 58—100 | .. | 5 0 0 |
| 737,142 | Stk. | Aug. 13 | 5 | West Ham, 5 p.c. Ord. | 93—58 | .. | 5 2 10 |
| | | | | WATER COMPANIES. | | | |
| 780,776 | Stk. | June 26 | 11⅛ | Chelsea, Ord. | 305—315 | .. | 3 13 0 |
| 150,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 147—150 | .. | 3 6 8 |
| 160,000 | ,, | ,, | 4½ | Do. 4½ p.c. Pref. '75 | 135—138 | .. | 3 5 3 |
| 175,785 | ,, | Mar. 31 | 4½ | Do. 4½ p.c. Deb. | 157—142 | .. | 3 3 5 |
| 1,720,560 | Stk. | Mar. 31 | 8 | East London, Ord. | 205—215 | .. | 3 14 5 |
| 654,740 | ,, | June 11 | 4½ | Do. 4½ p.c. Deb. | 138—143 | .. | 3 2 11 |
| 1,282,943 | ,, | ,, | 3 | Do. 3 p.c. Deb. | 92—95 | .. | 3 3 2 |
| 700,000 | 50 | June 11 | 10 | Grand Junction { 10 p.c. max. | 122—127 | .. | 3 18 9 |
| 310,000 | Stk. | Mar. 31 | 4 | 4 p.c. Deb. | 123—128 | .. | 3 2 6 |
| 708,000 | Stk. | Aug. 13 | 10½ | Kent | 275—285 | .. | 3 13 8 |
| 160,000 | ,, | ,, | 7 | Do. New, 7 p.c. max. | 190—200 | .. | 3 10 0 |
| 1,043,800 | 100 | June 26 | 11 | Lambeth, 10 p.c. max. | 292—297 | −2 | 3 14 0 |
| 406,200 | 100 | ,, | 8½ | Do. 7½ p.c. max. | 210—220 | .. | 3 17 3 |
| 350,000 | Stk. | Mar. 31 | 4 | Do. 4 p.c. Deb. | 122—127 | .. | 3 3 0 |
| 500,000 | 100 | Aug. 13 | 12 8/10 | New River, New Shares | 385—395 | −5 | 3 15 0 |
| 1,000,000 | Stk. | July 29 | 4 | Do. 4 p.c. Deb. | 121—124 | .. | 3 4 6 |
| 902,300 | Stk. | June 11 | 7½ | South-wark and Vauxhall { Ord. | 225—235 | −10 | 3 3 10 |
| 126,500 | 100 | ,, | 7½ | 7½ p.c. max. | 210—220 | .. | 3 8 2 |
| 489,200 | Stk. | ,, | 5 | 5 p.c. Pref. | 145—150 | .. | 3 6 8 |
| 1,019,585 | ,, | Mar. 31 | 4 | 4 p.c. A Deb. | 122—127 | .. | 3 3 0 |
| 1,155,066 | Stk. | June 11 | 10 | West Middlesex | 273—278 | .. | 3 11 11 |
| 200,000 | ,, | ,, | 4½ | Do. 4½ p.c. Deb. | 136—141 | .. | 3 3 10 |
| 200,000 | ,, | Sept. 11 | 3 | Do. 3 p.c. Deb. | 92—95* | .. | 3 3 2 |

* Ex div.

sanctioned. As to Provisional Orders issued by the Local Government Board, witness referred to three classes of cases in which the Board were empowered to grant Orders—namely, under the Gas and Water Works Facilities Acts, for amending Local Acts, and to enable authorities to acquire land compulsorily. Of the first class there had been only five during the last three years, of the second there had been issued 71 since 1900, and of the third 74.

Dealing with the question of municipal audit, witness remarked that there had been changes in connection with this matter since 1900. One town council had obtained power, by means of a Local Act, to adopt the Government system of audit; and the accounts of town councils, under the Education Act of 1902, had been made subject to this system. There was also then before Parliament a Bill promoted by the Plymouth Corporation, the Committee on which had required a clause to be inserted rendering the Council's accounts subject to Government audit. Objection had been made to the application of Government audit to municipal accounts, practically upon four grounds. The first of these was the delay which would be occasioned in the issue of the accounts; the second, the difficulty the auditor might have in the case of large boroughs in mastering the numerous Local Acts relating to the place; the third, the irritation which would be caused by the power of the auditor to make disallowances and surcharges; and the fourth, that expenditure in itself reasonable might be disallowed, or would be disallowed, because it was technically illegal. With regard to the third point, it had been suggested that men of high position might be unwilling to become members of town councils if they were subjected to these surcharges. Dealing with the first objection (delay in the issue of accounts), witness said his Department experienced this difficulty in the case of the county councils when they were first established; and it was met by means of a preliminary audit during the year, which very materially shortened the time needed for the legal audit after the end of the year. This had proved satisfactory; and a similar system might be employed if borough councils came under Government audit. Personally, he did not think there was very much in the alleged difficulty in the auditor mastering the Local Acts. It might apply to the first year; but the auditor would soon get to know all the provisions. At the present time, the Local Government Board had a permanent staff of about fifty auditors and half a-dozen assistant-auditors; and it was required that they should possess certain qualifications for the office. They had to be barristers or solicitors, to be taken from the staff of the Board, to be chartered accountants, or to have had a training under existing auditors. Therefore under the scheme he contemplated, he would merely increase the number of this staff. It was the practice to assign a district to an auditor; and therefore the same man would always go down to audit the accounts of a particular place. As to disallowances and surcharges, this system prevailed in the case of county councils, and his Department had never heard that persons of good position hesitated in consequence to undertake the duty of councillors. With reference to the disallowance of technically illegal, though reasonable, expenditure, it must be borne in mind that the Local Government Board had power, under the Local Authorities (Expenses) Act, 1897, to sanction an expenditure, and then the auditor could not disallow it. This had got rid of a great number of merely technical disallowances, and so had diminished friction. [Witness at this stage handed in the Parliamentary Return relating to the Reproductive Undertakings of Municipal Corporations, as noticed in the "JOURNAL" for Feb. 24, p. 467.]

Sir George Bartley (a member of the Committee) put a series of questions to witness with regard to the form in which municipal accounts are now issued. He remarked that there was a general feeling that the public did not quite know how the various items of expenditure were made up. Taking electric lighting, for instance, there was an idea among some persons that they could not get at the facts as to how the experiments in this regard in London and some of the large boroughs were really being carried out. What he wanted to know was, Could they, from the auditors' certificates, really ascertain the facts, so as to know exactly how the electric light was going on in London commercially? Witness replied that, taking the case of electricity works run by a local authority, the accounts which the auditor certified would show the sum spent during the year on the concern, but it would not give a balance-sheet with respect to the undertaking. The account would not be kept on what were called commercial lines—that was to say, it would not show a profit and loss account. Questioned as to whether he saw any objection to its doing so, witness said this touched a very important point. The Board had had the question raised as to whether the accounts of the London boroughs, for example, some of whom possessed municipal undertakings, ought to be kept on commercial lines—*i.e.*, showing, not actual receipts and payments during the particular year, but income and expenditure in respect of the undertaking. They were now considering the matter; and his opinion was that something might be done. The advantage that had been felt in having actual cash accounts kept was that they showed what the ratepayers did actually pay in the particular year; but, of course, the existing system was instituted at a time when local authorities did not carry out these undertakings to the extent they were doing now. If, instead of the Local Government Board appointing auditors, they established some form of accounts and left the localities to have them audited by a chartered accountant, the point to be considered would be, What would be the obligation on the local authorities to carry out the form which was prescribed? It seemed to him that the auditor would still want to have power in order to enforce the particular rule that was laid down. He did not know that there was any reason why auditors who were appointed by a Government Department to do work of this kind should not be well qualified for the purpose, and keep themselves always alive to the duties which they had to discharge.

In reply to other members of the Committee, witness said there were three municipal boroughs whose accounts were now passed by a Government auditor—Tunbridge Wells, Bournemouth, and Southend. In addition to these, Folkestone had power to adopt the system. Unless

RICHMOND'S
COOKERS.

GEO.
GLOVER'S
DRY
METERS.

GEO.
NEWTON'S
WET
METERS.

RICHMOND'S
GAS-FIRES.

town councils had special power under a statute, they were not compelled by any existing Act of Parliament to submit their ordinary accounts to a Government auditor; but county councils were bound to do so. He thought it desirable, in the interests of the ratepayers, that municipal corporations should be compelled to do as county councils had to. The work of auditing could be done quite as cheaply by the State as by the local authorities. He did not think any of the Board's auditors were chartered accountants; but the practice was to only appoint men who had had experience of auditing. It might be desirable, before the further auditors suggested were appointed, to insist upon their having some further qualification. The superiority of the Government system was in the fact that the auditor had power to surcharge or disallow illegal payments. The Local Government Board system of audit was in no way inconsistent with the accounts being prepared in a commercial way. They had at present under consideration the question whether this should be required in the case of councils possessing municipal trading undertakings; and therefore it did not seem to him that there was any antagonism between the two systems. It was suggested to witness that some time ago there was a case at Shoreditch where charges that rightly belonged to the electric lighting scheme were put to the account of the destructor; and he agreed that this was a thing which should be guarded against. In the case of a Government audit, cognizance would be taken of such an objection as was lately raised by the South Shields Gas Company, on the ground of its being an illegal application of the rates, to the Corporation (who had instituted an Electrical Department) to give current gratis for a certain number of months in order to secure consumers. The Board had formed no idea of the value of the assets represented by the debts of the corporations.

Mr. Albert Gray, Counsel to the Lord Chairman of the House of Lords.

The next witness was Mr. Albert Gray, who gave an account of the existing system of audit of local authorities' accounts in England and Wales. In the case of the boroughs generally the audit was by auditors appointed under the Municipal Corporations Act; but with all other local authorities, it was by the district auditors appointed by the Local Government Board. There were, however, the three exceptional boroughs mentioned by the previous witness. On the other hand, fifteen boroughs had taken powers to appoint professional auditors—that is to say, chartered accountants—and in ten of these cases the power had been exercised. In one instance, the professional audit was in lieu of the Municipal Corporations Act audit; but in the remainder it was in addition. Further, he was informed that all the greater corporations, without any express parliamentary powers, had appointed chartered accountants to audit their accounts, and in some cases different accountants to audit the accounts of the various departments. This, he understood, was the case at Birmingham, where there were separate auditors for the Gas Department, Electricity Department, Tramways Department, and so on. An effective system of municipal audit would go very far towards removing the evil results—which he believed did exist—of trading on the part of local authorities. There was a temptation, in the event of an enterprise being unproductive, to present the accounts in a form which made it appear more profitable than it really was; and this temptation, of course, was greater when the authorities concerned were aware that the audit was not going to be an efficient one.

Witness said he thought the Committee should take evidence to show the extent to which the professional audit to which he had referred had extended, the powers that were given to the auditors, and the regulations that were imposed upon them. The Committee ought also to know the nature of the reports on the accounts which the auditors furnished, whether their reports were published in full to the ratepayers in all cases, and whether they had any (and, if so, what) connection with the borough auditors. Professional auditors should be appointed by the corporations themselves; but their appointment, and likwise their dismissal, should be subject to the approval of the Local Government Board. The audit should be conducted under regulations made by the Board in the direction of securing uniformity in the matter of keeping accounts, as to the mode of audit, as to reports made by the auditor with regard to the misapplication of money, unauthorized payments, and wrong accounting, and as to the publication of the accounts and of the auditors' reports for the benefit of the ratepayers. Possibly there ought to be a power of surcharge somewhere; but he should not be disposed to give it to the Local Government Board or the auditor in the first instance. He should prefer to make the experiment of securing publicity by the means indicated, and leaving the rest to the ratepayers. He did not think that the provisions of the ordinary Local Government audit could be applied to municipalities generally; it would be certain to involve friction.

Mr. T. A. Welton, Chartered Accountant

Mr. Welton, who is Chairman of the Finance Committee of the Wandsworth Borough Council, gave it as his opinion that it would be in the public interest that local authorities should appoint their own auditors, provided they were limited as to their qualifications or the appointment was made from a list of names in the possession of the Local Government Board. He did not think it would be possible to lay down a standard form of accounts to be used with respect to all trading operations by municipalities; but it would be practicable to lay down principles to be followed in drawing up such accounts. It would also be possible for the Local Government Board to frame for particular kinds of enterprises the proper form of accounts, especially if there were power to revise the draft form with the assistance of representations from the boroughs. A separate balance-sheet ought to be made up with regard to each municipal trading enterprise, just as though it were a public company. A certificate should be required from officers in charge of, and responsible for, the proper maintenance and upkeep of premises and plant. It would not be advisable to make a periodical valuation of lands, buildings,


If You Want the Best

The
NAME
"Wright"
should
be on
every cooker
you buy.

John Wright & Co.,
Essex Works,
Birmingham.

and other permanent structures. The difference in value growing out of the lapse of time had nothing to do with the principles of taxation or the levying of rates. But anything in the shape of wastage that required to be replaced ought to be attended to; and for this purpose valuations from time to time might be needed. As regarded the transfer from one department of municipal expenditure to another of a proportion of certain outlays, this was a power that could be very much abused; and it ought to be placed specially under the safeguard of the auditor and of the Local Government Board. Work required to be done in the interest of any undertaking should be charged to that undertaking; each concern being treated as nearly as possible as if it belonged to an independent company.

Asked what depreciation ought to represent, witness replied wastage that was actually tangible; and it should also, in many instances, include further provision in case of works becoming obsolete. There were cases where the uses of things changed. If canals had been undertaken by municipalities, and had been succeeded by railways, there would have been a good deal of wastage in this way without the canals themselves falling out of repair. In like manner, gas and electricity competed; and there might be other instances in time to come. This sort of loss was likely to occur in a great many enterprises. The term of a loan was attributed as nearly as possible to the durability of the subject of it; and it was on this principle that he would suggest generally the allowance for depreciation. There were, however, cases in which the depreciation should be fixed independently of that, and based on practical experience. On the question of profits, he thought that establishment charges must be extended by the existence of municipal trading enterprises; and some reasonable apportionment ought therefore to be made. For instance, he did not suppose that the control of water and gas works was undertaken by a municipality without there being extra work cast upon the town clerk, the engineer, and other people connected with the central body; and it should be possible to apportion the expenses connected with this. In such cases, the new undertaking should pay, or be debited with, its share of the general salaries of the public officials. The true profit would be arrived at after paying all ordinary expenses, insurance, and taxes, and providing for depreciation arising from wastage and for the plant becoming obsolete. He would not be absolutely rigid with regard to the extinction of capital outlay. In the case of the water supply of London, he suggested to his Council that the extinction of two-thirds of the amount of the capital cost would be quite enough to accomplish by means of a sinking fund, because there would be a very considerable asset left at any distance of time. In the case of a private water undertaking, probably, instead of writing off two-thirds of the capital, there would be almost nothing written off in the course of the same period of time. It would be maintained out of revenue; and consequently it would most likely be a growing asset. Wherever there was depreciation it should be allowed for; but depreciation was a very variable quantity, though in the case of the ordinary municipal trading undertaking, there would always be some kind of depreciation. From what he gathered, this depreciation was in some cases not by any means provided for; so that the profits seemed greater than they really were. This, he thought, often happened. The responsibility of saying whether depreciation was allowed for, and if so what the rate allowed was, should fall upon the auditor.

An important point was raised by Mr. Platt-Higgins, who put the following question to witness: "How would you deal with a sudden depreciation of a plant arising from its having become obviously obsolete? I will take the case you mentioned yourself—a gas plant being obviously superfluous from being superseded by electricity; or take another case: Suppose a municipality have laid out a very large sum in putting up fixed generating stations and overhead wires, and they are superseded by self-contained motor-cars, and therefore become obviously obsolete and superfluous. We will assume the municipality have laid out a sum of £100,000 on such generating stations and overhead wires; and when they are superseded, we will assume, for the sake of argument, they are worth £20,000. How would you deal in the profit and loss account with the £80,000?" Witness replied: "I should expose it as a loss; and I should consider it a matter of policy how that was to be dealt with. The sudden arriving of a catastrophe like that is not a thing one is familiar with. Gas companies still live, in spite of electric lighting; but if there were a loss of £80,000 ascertained at a particular date, I think it would be a question which ought to be dealt with as to the steps by which it was to be wiped out. It could not immediately be thrown on the rates of the year; but it might be very well subjected to a sinking fund extinction, such as is adopted in the case of assets that are of no profit-producing value." He did not think that the possibility of this sudden loss, by plant becoming obsolete, had for a single moment, been thought of by the ratepayers.

## PROGRESS OF THE DERWENT WATER SCHEME.

Some very interesting particulars have lately been published by the "Birmingham Daily Post" as to the progress that is being made with the extensive water-works undertaking in the Peak of Derbyshire, in which the towns of Sheffield, Leicester, Nottingham, and Derby are chiefly interested. The complete scheme includes five reservoirs, which will impound nearly 11,000 million gallons of water, gathered from a watershed which has an area of about 50 square miles, and is capable of yielding an average of 50 million gallons of water per day. One-third of this, however, will be restored to the river by way of compensation, leaving two-thirds available for public use. At least 2 million tons of stone will be used in building the dams, which are to be of solid masonry from the foundations up; and the aggregate cost of the works, including filter-beds, aqueducts, and pipe-lines, will be £7,000,000 sterling. Of this total sum, the Derwent Water Board will be responsible for £5,800,000, which covers the cost of building the five reservoirs in

FOR RELIABLE

VALVES

OF ALL KINDS FOR GAS-WORKS

SEND YOUR ORDERS DIRECT TO

C. & W. WALKER, Ltd.,

MIDLAND IRON WORKS:
Donnington, near Newport, Salop.

LONDON OFFICE:
110, Cannon Street, E.C.

NEW EDITION of VALVE CATALOGUE SENT on APPLICATION.

the Derwent and Ashop Valleys, making 14 acres of filter-beds at Bamford, carrying an aqueduct 30 miles long to Ambergate, making a small service reservoir at this point, and laying a pipe-line to Sawley, on the Trent. The cost will be shared by the authorities interested in the undertaking in proportion to the amount of water they take. Leicester is to have 35·72 per cent., Sheffield and Derby 25 per cent. each, and Nottingham 14·28 per cent., subject to certain claims of the counties of Derby and Nottingham. Sheffield will carry off its allowance by means of the aqueduct through the hills to the Rivelin reservoir; Leicester and Nottingham will convey their respective quota from Sawley; and Derby will help itself by a pipe-line from Ambergate. The cost of the subsidiary works is roughly estimated at about £1,100,000.

## NOTES FROM SCOTLAND.

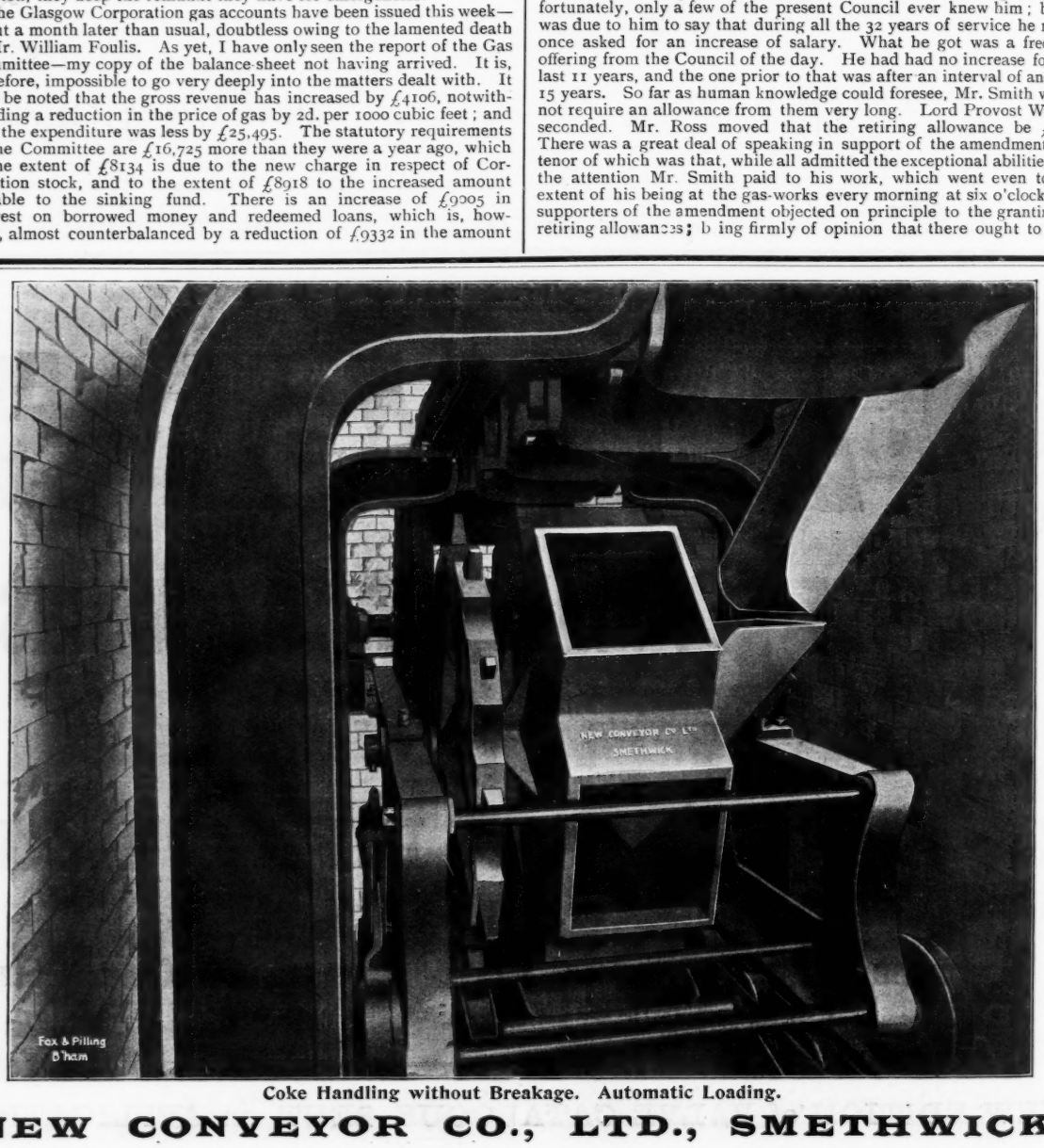
**From Our Own Correspondent.**

*Saturday.*

The meeting of the Waverley Association at Haddington on Thursday was, as the meetings of the Association always are, a most pleasant and instructive one. There is a freedom of speech at the Waverley meetings which is not to be found everywhere; and thus an at-home air is given to the gathering. But there is a freedom also for friends to speak, which allows the views of manufacturers to be given. The trader is no bogey to the members of the Waverley Association; and I think anyone who reads the remarks of Mr. O'Connor and Mr. Main at Thursday's meeting will agree that a muzzling order upon them would have been a loss to the Association. I would recommend that the President's address be perused, because of the interesting series of tests of the heating power of gas which it contains. The subject is supremely interesting, and will bear trial at home by anyone who wishes to check or verify Mr. Blair's figures. The incident he relates about the Torbanehill mineral is interesting as a curiosity, but as a curiosity only, because the substance is out of the market. In Haddington, they keep the remnant they have for emergencies.

The Glasgow Corporation gas accounts have been issued this week—about a month later than usual, doubtless owing to the lamented death of Mr. William Foulis. As yet, I have only seen the report of the Gas Committee—my copy of the balance-sheet not having arrived. It is, therefore, impossible to go very deeply into the matters dealt with. It is to be noted that the gross revenue has increased by £4106, notwithstanding a reduction in the price of gas by 2d. per 1000 cubic feet; and that the expenditure was less by £25,495. The statutory requirements of the Committee are £16,725 more than they were a year ago, which to the extent of £8134 is due to the new charge in respect of Corporation stock, and to the extent of £8918 to the increased amount payable to the sinking fund. There is an increase of £9005 in interest on borrowed money and redeemed loans, which is, however, almost counterbalanced by a reduction of £9332 in the amount paid in annuities; this reduction being due to the extensive redemption of annuities during the year, which, again, is partly the result of the new conversion scheme. The larger yield and better prices for residuals have helped the revenue greatly; but I cannot yet say to what extent. That the business is increasing is evident from the number of meters in use, which show an increase of 6365 during the year, as compared with an increase of 3193 in the year preceding. There are, roughly speaking, 10,000 more consumers of gas at the present time than there were two years ago. Gas-stoves hired out have increased by 1246, as compared with 1552 in the previous year; and heating and cooking appliances sold show an increase of 322. The effect of the year's working has been not only to wipe out a debit balance of over £15,000 in the accounts of the department, but to extinguish the debt of over £13,000 incurred last year in the Electricity Department, and to leave a balance of £19,124, which has been applied in connection with the conversion scheme. All this is quite satisfactory, and shows the enormous vitality of the great undertaking.

The Town Council of Aberdeen had three subjects relating to the gas undertaking before them on Monday. First there was the proposal by the Gas Committee to grant a retiring allowance of £250 a year to Mr. A. Smith on his retiring from the post of Engineer and Manager of the gas undertaking. When the subject came up for consideration, the Town Clerk read a resolution which had been forwarded by the Aberdeen Labourers' Federation, in which they protested against the proposed retiring allowance. Mr. Kemp, the Convener of the Gas Committee, in moving the adoption of the recommendation of the Committee, said that Mr. Smith went to them with the undertaking itself, in the day of small things. Then a modest 14,000 tons of coal sufficed to make the 146¼ million cubic feet of gas required by the citizens of that day. To-day the demand has risen to 641½ millions, and over 57,000 tons of coal are required in its manufacture. Then the price was 5s., which produced a revenue of £33,000. To-day the price is 3s., which brings a gas-rental of nearly £90,000. Then the sale of coke gave £834; to-day it yields over £9000. Tar, &c., the fnurnished some £2000; last year it brought in over £12,000. Through all these marvellous developments, Mr. Smith stood as the central figure. Unfortunately, only a few of the present Council ever knew him; but it was due to him to say that during all the 32 years of service he never once asked for an increase of salary. What he got was a free-will offering from the Council of the day. He had had no increase for the last 11 years, and the one prior to that was after an interval of another 15 years. So far as human knowledge could foresee, Mr. Smith would not require an allowance from them very long. Lord Provost Walker seconded. Mr. Ross moved that the retiring allowance be £150. There was a great deal of speaking in support of the amendment, the tenor of which was that, while all admitted the exceptional abilities and the attention Mr. Smith paid to his work, which went even to the extent of his being at the gas-works every morning at six o'clock, the supporters of the amendment objected on principle to the granting of retiring allowances; being firmly of opinion that there ought to be a




Coke Handling without Breakage. Automatic Loading.

NEW CONVEYOR CO., LTD., SMETHWICK.

superannuation fund for the officials. A further amendment was moved by Treasurer Wilkie, to the effect that the allowance be £200. The Council divided on the proposal. The recommendation of the Committee received only seven votes, and so did the amendment of Treasurer Wilkie. The other amendment received 18 votes; and that being a clear majority of the Council, the retiring allowance was, in terms of it, fixed at £150.

The next subject was that of the annual accounts, to which was tacked on a discussion upon the charge for gas consumed through prepayment meters. I dealt with the accounts in my notes last week (p. 632) and need not go further into them than to repeat that they contain a record of exceptionally satisfactory work, and work which, it should not be forgotten, was done when the head of the establishment was unable to give any assistance to his staff. The situation reflects the very greatest credit upon the organization of the department and the spirit which animates the assistants whom Mr. Smith had gathered round him. It is a very high tribute both to the ability of Mr. Smith to manage, and to the capacity of his assistants, to be able to say that when his guiding hand was withdrawn, the work went on in the same progressive manner as before. Turning to the subject of prepayment meters it must be confessed that it is one which deserves to be looked into. The allowance is at the rate of 20 cubic feet of gas for 1d., as compared with 28 cubic feet to the ordinary consumers. Statistics on this point are difficult to get; but the proportion seems to be somewhat too great. So long as the use of prepayment meters is an experiment, it may be permitted to put on a charge which will safely cover all risks. But by this time it should be known what the extra charge ought to be; and, considering what the object is, the extra charge should rather be less than cost price, instead of being more. The Gas Committee have undertaken to consider the matter; and it is likely that they will do so in a fair spirit. It is not often that a subject of such wide application is discussed in corporations, as this is; and it is not often that, when objection is taken to the policy of a Corporation adventure, such good ground can be shown for inquiry. The discussion in Aberdeen will doubtless set other people thinking.

The annual meeting of the St. Andrews Gas Company was held on Thursday. The report of the Directors, the adoption of which was moved by ex-Bailie Aikman, the Chairman, stated that the results of the working for the past year had been a record. The total income was £8658—an increase of £542 over the previous year; and the profits on the year's working amounted to £1643. The quantity of gas manufactured was 46,500,000 cubic feet—an increase of 1,500,000 feet. The Directors were alive to the ever-increasing demands for gas, and were completing the erection of a new gasholder capable of containing 100,000 cubic feet, and arranged so that its capacity may be doubled when necessity arises The number of consumers showed an increase of 75 over the previous year. Of the consumers, 307 are supplied through prepayment meters; and there are gas-stoves on hire of the value of £497, yielding a rental of £47. The Directors regretted the removal by death of their late Chairman, Mr. J. Ritchie Welch, who had been a Director for nineteen years and Chairman for fourteen years. The usual dividend of 50s. per share was declared. The Chairman said that the excellent results of the year's working were, in great measure, due to the splendid management of Messrs. J. & R. Hall, the Managers. The report was adopted.

The valuation of the Hamilton Corporation gas-works has been fixed at £4540, and to that has been added £196 for pipes. The Corporation are to appeal against the valuation.

The Corporation of Newport (Fife) on Monday reduced the price of gas from 4s. 10d. to 4s. 8d. per 1000 cubic feet. When they took over the undertaking in the summer of 1901, the price was 5s. 5d. per 1000 cubic feet, so that in two years they have effected a reduction of 9d. This reduction, too, has followed, or been partly concurrent with, an expenditure of about £22,000 in the purchase of the old works and the erection of the new gas-works which were opened in May last. On Monday night, the proceedings were not quite harmonious, the difficulty being that it was the Finance Committee of the Corporation who proposed the reduction, whereas the Gas Committee had recommended the retention of the price at 4s. 10d. Mr. Thom, who is Convenor of the Finance Committee, moved the reduction. He dealt with the general finances of the burgh, which are in a flourishing condition, and, referring to the accounts of the Gas Department for the current year, said that the total revenue, including a credit balance carried forward from last year, was estimated at £4079, and the expenditure at £3205, which would leave a surplus at the end of the year of £874. These estimates were based on the reduction of 2d. per 1000 cubic feet. Being, he said, the first year's operations at the new works, they deemed it advisable to move cautiously; but, so far, the works were showing very good results. He would be very sorry if there should be any feeling that he was usurping the powers of the Gas Committee; but he conscientiously believed that he was warranted in proposing the reduction. The Auditor had stated that they would be quite justified in reducing the price of gas by 6d. per 1000 cubic feet. Mr. Robertson, in seconding the reduction, said that the taking over of the gas undertaking had been a great success. Mr. Leitch moved that the price remain at 4s. 10d., as recommended by the Gas Committee. He was sorry at being put into the position of voting against a reduction in the price of gas, but there was a larger question before them, arising out of the manner in which the matter had been brought forward; and he felt constrained to relieve his feelings, not so much as regarded the proposed reduction, but as to what had led up to it. If they gave effect to the proposed reduction, they would be establishing a dangerous precedent, because it would be brought about in the interests of two Conveners who had set themselves to override the decision arrived at by the majority of the Gas Committee. Mr. Carswell thought they ought to pay back a large part of the £22,000 which they had expended as quickly as possible. Mr. Thom regarded the amendment as a vote of censure on himself. Provost Roger advised that all such references should be withdrawn; and the parties having agreed to this course, the proposed reduction was agreed to.


# CARBURETTED WATER-GAS APPARATUS

**Merrifield—Westcott—Pearson Patents.**

## The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

**London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.**
**American Offices: TORONTO.** TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

**The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—**

| | Cub. Ft. Daily. | | Cub. Ft. Daily. | | Cub. Ft. Daily. |
|---|---|---|---|---|---|
| BLACKBURN | 1,250,000 | ST. CATHERINES (Remodelled) | 250,000 | ACCRINGTON | 500,000 |
| WINDSOR ST. WORKS, BIRMINGHAM | 2,000,000 | KINGSTON, PA. | 125,000 | TONBRIDGE | 300,000 |
| SALTLEY WORKS, BIRMINGHAM | 2,000,000 | PETERBOROUGH, ONT. | 250,000 | STRETFORD | 500,000 |
| COLCHESTER | 300,000 | WILKESBARRE, PA. | 750,000 | OLDBURY | 300,000 |
| BIRKENHEAD | 2,250,000 | ST. CATHERINES (Second Contract) | 250,000 | TODMORDEN | 500,000 |
| SWINDON (New Swindon Gas Co.) | 120,000 | BUFFALO, N.Y. | 2,000,000 | SALTLEY, BIRMINGHAM (Third Contract) | 2,000,000 |
| SALTLEY, BIRMINGHAM (Second Contract) | 2,000,000 | WINNIPEG, MAN. | 500,000 | YORK (Second Contract) | 750,000 |
| WINDSOR ST., BIRMINGHAM (Second Contract) | 2,000,000 | COLCHESTER (Second Contract) | 300,000 | ROCHESTER (Second Contract) | 500,000 |
| HALIFAX | 1,000,000 | YORK | 750,000 | NEWPORT (MON.) | 250,000 |
| TORONTO | 250,000 | ROCHESTER | 500,000 | TOKIO, JAPAN | 1,000,000 |
| OTTAWA | 250,000 | KINGSTON, ONT. | 300,000 | PERNAMBUCO (Brazil) | 125,000 |
| LINDSAY (Remodelled) | 25,000 | CRYSTAL PALACE DISTRICT | 2,000,000 | MALTON | 150,000 |
| MONTREAL | 500,000 | DULUTH, MINN. | 300,000 | DULUTH, MINN. (Second Contract) | 300,000 |
| TORONTO (Second Contract Remodelled) | 2,000,000 | CATERHAM | 150,000 | BROCKVILLE (ONT.) | 250,000 |
| BELLEVILLE | 250,000 | LEICESTER | 2,000,000 | SMETHWICK | 500,000 |
| OTTAWA (Second Contract) | 250,000 | ENSCHEDE (HOLLAND) | 150,000 | GRAVESEND | 300,000 |
| BRANTFORD (Remodelled) | 200,000 | BUENOS AYRES (RIVER PLATE CO.) | 700,000 | NEWPORT MON. (Second Contract) | 250,000 |
| | | BURNLEY | 1,500,000 | TORONTO (Third Contract) | 750,000 |
| | | KINGSTON-ON-THAMES | 1,750,000 | TORONTO (Fourth Contract) | 1,000,000 |

**Complete Gas-Works at NELSON, BRITISH COLUMBIA.**

**LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.**
**MONTREAL, ONT. (Second Contract) . . . . . 1,800,000 Cub. Ft.**

A discussion took place in the Helensburgh Town Council this week upon a proposal to increase the salary of Mr. W. Blair, the Manager of the gas undertaking, by £20 a year. The proposal was the outcome of a consideration by the Finance Committee of the salaries of various officials, more than one of whom was recommended for an increase, and was not made on the initiative of Mr. Blair. The strange thing was that, in the case of Mr. Blair, the increase was opposed by Mr. Watson, the Convener of the Finance Committee. He did so, he said, on public grounds, which were that Mr. Blair had an increase of £20 last year, and had not the length of service to entitle him to another. Mr. Mackay, the Convener of the Gas Committee, supported the increase, on the ground that when they appointed Mr. Blair, four years ago, they gave him a low salary on the understanding that if he performed his duties satisfactorily, which he had done, they were to raise his salary. He held that they were under obligation to do so. The Council, by six votes to four, refused the increase. Mr. Mackay subsequently resigned his convenership, because of the position he had been put in by the vote. Regret was expressed at this turn of affairs, as under Mr. Mackay's convenership the transfer of the gas undertaking was affected, and its conduct ever since has been a conspicuous success.

## CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 12.

**Sulphate of Ammonia.**

There has been good demand throughout the week, and values have slightly improved, the closing quotations being £12 2s. 6d. to £12 3s. 9d. per ton f.o.b. Hull, £12 5s. per ton f.o.b. Liverpool, and £12 6s. 3d. Leith. The Continent remains very quiet, and requirements have been mainly for the Colonies and for covering September contracts. There has been further buying for January-June, 1904, delivery at £12 10s. per ton, ordinary terms, f.o.b. Leith, but makers now require £12 12s. 6d. to £12 15s. per ton in that position. London, Beckton terms, is firm, at £12 7s. 6d. per ton for delivery up to the end of the year.

**Nitrate of Soda.**

This is firmly held in all positions, and the spot prices are 9s. 10½d. per cwt. for ordinary quality and 10s. 3d. per cwt. for refined.

LONDON, *Sept.* 11.

**Tar Products.**

The markets remain in about the same position. There is not very much business doing for early delivery. In pitch, the demand for prompt delivery continues good; but for next year there is great uncertainty as to value. Dealers are quoting very low prices, evidently believing in a fall; whereas makers decline to offer forward at any great reduction on existing prices, as in most instances they have paid high figures for their tar, and rely on the value of pitch being maintained to enable them to work at a profit. In benzol, there is a good business doing, and the demand for gas-enriching continues to increase. So far as London is concerned, there are no stocks. Makers ask 9¼d. to 9½d. for forward delivery, although nothing over 9d. has yet been paid for prompt delivery. It must be borne in mind that the production will increase in a month or so, when there will be more offering. There does not appear to be any demand of importance from the Continent. Probably the reported increase in the German make will account for this. In 50-90 per cent. business has again been done at 7d. for home consumption, September-October delivery; but this quality is not very much inquired for at present. Toluol is very dull indeed; and there is no business doing. In solvent, the demand for the heavy quality continues very good, and several contracts have recently been made at good prices for forward delivery. Crude carbolic is firm at 1s. 6d., at which contracts have just been made for delivery up to the end of the present year. There is a better demand for crystals, several orders having been taken for export at slightly improved prices. The demand for creosote continues good, especially in London for export. As regards tar, there is nothing fresh to report; but prices have still a tendency to be easier. The uncertainty as regards pitch will cause distillers to be cautious as to the price to be paid for the raw material.

The average values during the week were: Tar, 24s. to 31s. Pitch, London, 54s.; east coast, 52s. 3d. to 52s. 6d.; west coast, 50s. 9d. to 51s. 3d. Benzol, 90 per cent., 9d.; 50-90 per cent., 7d. Toluol, 6½d. Crude naphtha, 2½d. to 3d.; solvent naphtha, 7d. to 8d.; heavy naphtha, 9d. Creosote, London, 1⅜d. to 1 7/16d.; North, 1¼d. Heavy oils, 2⅛d. Carbolic acid, 60 per cent., 1s. 6d. Refined naphthalene, £5 to £8 10s.; salts, 23s. to 26s. Anthracene, "A" quality, 1¾d. to 1⅞d.; "B" quality, 1d. nominal.

**Sulphate of Ammonia.**

The markets remain in about the same position. Values do not improve much, although during the last few days slightly higher prices have been realized. The Gaslight and Coke Company sold some quantity of Beckton make at £12 6s. 3d., but still quote £12 7s. 6d. for prompt and £12 10s. for forward. For London, the price may be taken as £12 5s. As regards Hull, there is not much business doing, and the market value is not over £12 2s. 6d. In Leith, business has been done at from £12 3s. 9d. to £12 5s.; and the same values apply to Liverpool.

**A Proposed Bridge for Water-Mains over the Trent.**—The Nottingham City Council last week had before them a recommendation by the Water Committee to construct a 6-foot wide bridge across the River Trent to carry two 15-inch water-mains; the cost being estimated at £2900. After a long discussion, however, the matter was referred back to the Committee; there being a feeling that, if a bridge was to be constructed, it might just as well be on a larger scale, so as to be available for traffic. This unfortunately at present is quite impossible for, Alderman Radford stated that "they could not raise the money."


THE

# MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

PREVENTS NAPHTHALENE DEPOSITS.

OVER **100** MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

**Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Seven Years.**

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

**THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.**

**The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.**

**Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.**

**For Prices and full Particulars, apply to**

**THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,**

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

## COAL TRADE REPORTS.

**Lancashire Coal Trade.**

The continued unsatisfactory industrial condition throughout Lancashire affords anything but a promising outlook for the coal trade of the district. A slackening off as regards new work is the report in many branches of engineering; and the returns of the Trades Union organizations show all round an increase in the number of members coming on their books for out-of-work support. Short time is still being worked in the cotton manufacturing districts, and the textile machinery trades remain in an extremely depressed condition. All this tends necessarily to restrict requirements for iron making, steam, and general manufacturing purposes, and the effect is becoming noticeable as regards the lower classes of fuel used for steam purposes. Supplies of slack are more plentiful on the market; and although the better sorts are moving away fairly well, the lower qualities are, at many of the collieries, more or less of a drug. Considerable surplus supplies are being sent in from Staffordshire; and in other surrounding mining districts, such as Yorkshire, Derbyshire, and Nottinghamshire, slack is plentiful. The result is that there is a good deal of surplus offering on the market for clearance sale at low-cut prices. The general quoted pit rates at the Lancashire collieries remain, however, without any material change. But slack is still quoted 6s. 3d. to 6s. 9d., good medium sorts 5s. and 5s. 3d. to 5s. 9d., with common slacks about 4s. and 4s. 3d. up to 4s. 6d. per ton. With regard to round coals, house-fire requirements do not yet show sufficient increase to bring about any appreciable improvement in this branch of trade. It is still exceptional where collieries are working more than three to four days per week; and supplies are ample to meet the demand. Buyers who are in a position to take anything like quantities can find sellers with special quotations at under the list rates, and present conditions do not favour an early hardening in prices. Best Wigan Arley remains about 13s. 6d. to 14s. 6d. per ton at the pit, seconds Arley and Pemberton four feet from 11s. and 11s. 6d. to 12s. 6d., and common house-fire coals 9s. 6d. to 10s. 6d. With plentiful supplies on the market, both from Lancashire collieries and outside districts, there is a tendency here to give way a trifle where orders of moment are to be secured; and the market generally is barely maintaining the full rates which were being very generally quoted in anticipation of improved conditions of trade. Common steam and forge coals can be bought readily for inland sales at from 8s. to 8s. 3d. per ton at the pit, medium sorts 8s. 6d., and best qualities 8s. 9d. For shipment, prices are rather lower than these; and delivered at the ports on the Mersey, steam coal ranges from about 9s. 3d. up to 9s. 9d. per ton.

**Northern Coal Trade.**

There is renewed briskness in the coal trade, more especially in the steam coal branch, in which there is now more disposition to ship freely on the contracts, and thus to anticipate the closing of the Baltic season. Best Northumbrian steam coals are steady at from 10s. 10½d. to 11s. per ton f.o.b. for early delivery, second-class steams are from 9s. to 9s. 3d., and steam smalls are about 5s. 6d., with a fair general demand and a tolerably full production. In the gas coal trade, there have been a few more contracts for the next exporting season—in one case a large quantity having been sold for export over the whole of next year at about 8s. to 8s. 7d. per ton f.o.b.; while in other cases the rate is not materially different. For occasional cargoes, the price quoted is from 8s. 9d. to 9s. per ton f.o.b.; and the output is now well taken up. Rather high prices are being quoted for gas coke f.o.b., but the inland gas companies feel the effect of the increasing production, and, as at Darlington, have in some instances quoted lower prices.

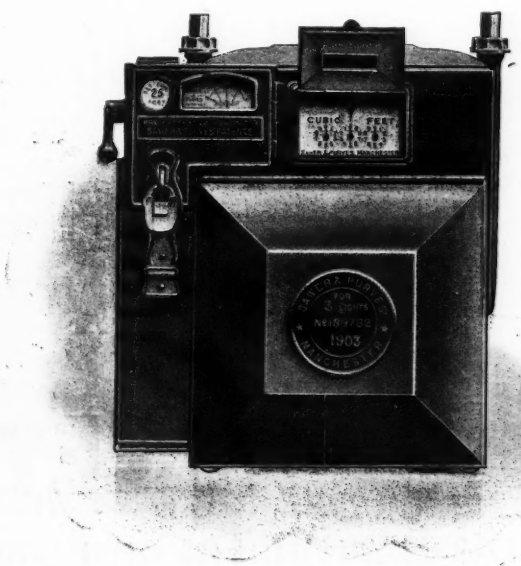
**Scotch Coal Trade.**

A somewhat better tone has prevailed, there being a good demand for all classes except splint, which is plentiful and is being pushed at prices a shade easier. For other varieties, the output is being taken up. The prices quoted are: Main 7s. 9d. to 8s. per ton f.o.b. Glasgow, ell 8s. 6d. to 9s., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 254,313 tons—an increase of 15,718 tons upon the previous week, and of 28,802 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,449,769 tons—an increase of 280,242 tons upon the same period of last year.

**Free Gas Stoves and Meters at Bollington.**—The Bollington Urban District Council at their meeting last Thursday resolved that, as from Jan. 1 next, the charge for the hire of small cookers shall be abolished; the rent for larger sized ones at the same time to be reduced by 4s. per annum. A discount is to be allowed to slot meter consumers of 20 per cent. on collection, provided a minimum of 8000 cubic feet of gas per annum is consumed. Gas-meter rents are also to be abolished as from the beginning of next year. The Council and their Manager (Mr. H. Froggatt) are evidently determined to do all they can to popularize the use of gas.

**Disposal of Profits at Lancaster.**—The volume of accounts for the past year of the Lancaster Corporation, which has been issued by the Borough Accountant (Mr. Clough), contains an interesting return showing the disposal of the net profits of the gas, water, and electricity works. Gas has contributed to the rates every year since 1892-3, with two exceptions; the amounts varying from £500 to £2147. This year the amount handed over was £1500. In the years 1879-81, a sum of £636 was handed over to the rates; the concern being managed by the Gas Company for the benefit of the Corporation. The Water Department contributed profits in relief of rates in 1881-2, when £500 was paid. From 1886-7 (with one exception) sums varying from £200 to £5334 have been given annually in relief of rates; the amount this year being £4740. Nothing has been placed to reserve or renewal funds since 1894-5. The Electricity Department, after being worked for three years at a loss of £913, has for five years paid sums varying from £88 to £1191 to the rates. In 1901-2 and 1902-3, the net profits of £931 and £1353 respectively were placed to the reserve fund.

S&P




THE "POSITIVE" DRY METER

**Wilful Breaking of Lamp Glasses at Oldbury.**—During the hearing of a case in which a boy ten years of age was charged with damaging a lamp belonging to the Oldbury District Council, Mr. A. Cooke, the Gas Manager, informed the Bench that it cost the department £100 a year to repair lamps wilfully broken by boys. It is to be feared that the penalty inflicted in this instance—1s. fine and costs, together with 2s. the amount of the damage—will not go a great way towards curing this very prevalent form of mischief.

**Harrogate Water-Works Extensions.**—A Local Government Board inquiry has been held by Mr. M. K. North in regard to an application by the Harrogate Corporation for sanction to a loan of £7000 for the provision of additional filter-beds and pumping plant in connection with the Irongate Bridge and Harlow Hill reservoirs. The Corporation have taken over the Knaresborough Water-Works; and on the 29th inst. will commence to supply the town with water. With this increased demand, the Corporation will, in the height of the season, be furnishing a water supply for 50,000 people.

---

Messrs. H. Greene and Sons, Limited, have received an order for a solid-plate lead saturator for the Brighouse Gas-Works; and their tender has secured the contract for a complete sulphate plant, including a solid-plate lead saturator, for the Littlehampton Gas-Works.

It is stated that Mr. J. Jamison, of Dunedin, New Zealand, has written to the Liverpool Corporation, giving particulars of a scheme for harnessing the tides, in order to generate electricity. Mr. Jamison considers that enough electricity could easily be generated from the Mersey tides to light the city electrically and drive the tram-cars. His proposal has been referred to the Resident Electrical Engineer.

The prospectus has been issued of the First Garden City, Limited; the capital being fixed at £300,000. The returns to the shareholders are to be limited to 5 per cent. per annum; and the surplus profits are to be applied for the benefit of the town or its inhabitants. The purchase price of the estate secured at Hitchin is about £150,000. The town will be limited to a population of some 30,000; and the greater part of the land will be retained for agricultural purposes.

It was noticed on Saturday evening at His Majesty's Theatre that there was a strong smell of gas behind the stage; and the escape was traced to a room which was locked from the inside. The fireman broke open the door, and found one of the employees lying on the floor. Before the doctor arrived, the man had died. An examination revealed the fact that the tap of a gas-burner had been turned on. The room was filled with gas; and a moment or two elapsed before anyone could enter.

The Droitwich Town Council having applied to the Local Government Board for permission to borrow £1000 for gas-works extensions, Mr. H. P. Boulnois last week held an inquiry into the matter. Mr. J. B. Wright and the Rev. J. Lord attended on behalf of the Ratepayers' Association, and protested against the loan. The Town Clerk explained that the money was required for laying pipes to supply the rapidly-increasing district of Witton, for laying a 10-inch main from the works to Winnett's Lane, and for providing a new station meter and enlarging the meter-house.

In addition to the catalogue noticed last week, Messrs. Falk, Stadelmann, and Co. have now issued another, dealing exclusively with public lighting. The first part is devoted to burners, taps, mantles, glasses, lighting devices, and accessories; and then follows a section on lanterns. Most of the illustrations of these are from actual photographs; and the styles are so diversified, and the range of prices so extensive, that the requirements and fancies of purchasers cannot fail to be met. Self-intensifying lamps are found among the others. Lamp columns and brackets are also shown.

According to the correspondent of "The Times," Metz has—owing to a dispute between the military and municipal authorities—been practically deprived of water. Since the town has been in German hands, the Governor has repeatedly endeavoured to persuade the Council to provide a supply of good water from sources within the line of fortifications; but the matter has so far been shelved, and the place has remained supplied from Gorze on the French frontier. Owing to an outbreak of typhoid fever last month near these reservoirs, the military authorities contrived to get them closed. This action was followed up by a telegram in which the German Emperor urged Prince Hohenlohe-Langenburg, the Administrator of Alsace-Lorraine, to take the strongest measures to put an end to the existing state of affairs, and to force the town to do its duty. The Council have since held a meeting, at which the Emperor's telegram was discussed, and a resolution was passed protesting against the assertion that typhoid fever was epidemic in Metz, and that the water from Gorze was tainted. It was also resolved to present a memorial based on this resolution to the Emperor, and to point out that the Council had already taken steps to ensure that the water supply should be pure.

Presiding at the statutory meeting of the New Incandescent Oil-Light Company, Limited, last Thursday week, Mr. Julius Moeller said of the 24,000 shares available for allotment to the shareholders of the old "Era" Incandescent Oil-Lamp Company, applications had been received so far for 22,074. The intention of the Directors was to adopt the Pittner lamp, which had been a great success, and had sold largely in Vienna. There was no reason, he thought, why the sales should not be equally considerable in this country. Two important wholesale houses had agreed to assist in its sale, and agents would be appointed in various towns. The "Era" Company made it a condition in the agreement with this Company that Mr. de Fonblanque and himself should have seats on the Board, and that a shareholder of the "Era" Company should also be elected a Director. No remuneration was payable to the Directors until a profit had been earned; and it had, therefore, been difficult to find a third gentleman to devote the necessary time and attention to the business. A resolution, moved by the Chairman and seconded by Mr. de Fonblanque, was then passed, authorizing the Directors to allow such of the letters-patent acquired from the "Era" Company to lapse as, in their absolute discretion, they might deem expedient.


# IMPORTANT.

# IF

## YOU WANT QUICK DISPATCH

send all orders for

## SLOT INSTALLATION FITTINGS,

## PENDANTS,

## BRACKETS,

## INVERTED FITTINGS,

## MAIN COCKS

(OF EVERY DESCRIPTION),

## SYPHON AND LUBRICATOR PUMPS

TO

# WILLEY & CO.,

## LONDON and EXETER.

**Quotations cheerfully given for all kinds of Gas Fittings.**

## WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

### Situations Vacant.

SECRETARY. Truro Gas Company. Sept. 23.
HEAD DRAUGHTSMAN (Producer Gas). No. 4095.
ASSISTANT INSPECTOR. No. 4097.
WORKING FOREMAN. Ascot Gas Company.
FITTER AND SMITH. No. 4072.
STOKERS. Godalming Gas-Works.
STOKER. Hythe (Kent) Gas-Works.

### Situations Wanted.

GAS STOVE TRADE. No. 4091.
LECTURES ON GAS COOKING, &c. Madame Alting-Mees, London.
MANAGER. No. 4089.
SECRETARY AND MANAGER SMALL WORKS. No. 4096.

### Agent Wanted by French Company. No. 4094.

### Classes in Gas Manufacture, &c., Battersea Polytechnic.

### Plant for Sale.

CAST-IRON PURIFIERS AND VALVES. Draycott Gas-Works.
GAS METERS (Dry). Llandudno Gas Department.
SMALL PRIVATE GAS-WORKS PLANT. Estate Office, Aylesford.

### Plant Wanted.

GASHOLDER TANK. No 4085.
RETORT BENCH FITTINGS. Chichester Gas-Works.

### Gas-Works to Let. No. 4093.

### Meetings of Companies.

BRITISH GASLIGHT COMPANY. London Office, Sept. 30. Twelve o'clock.

### TENDERS FOR

**Benzol.**
ROCHDALE GAS DEPARTMENT. Tenders by Sept. 23.

**Breeze.**
COMMERCIAL GAS COMPANY. Tenders by Sept. 23.

**Carbon.**
COMMERCIAL GAS COMPANY. Tenders by Sept. 23.

**Coke.**
COLNE GAS DEPARTMENT. Tenders by Sept. 18.

**Covered Service Reservoirs.**
BRADFORD CORPORATION. Tenders by Oct. 1.

**Gas Oil.**
BARROW-IN-FURNESS CORPORATION. Tenders by Sept 23.

**Light Oil.**
BRIDGEWATER TRUSTEES, MANCHESTER. Tenders by Sept. 21.

**Light Railways and Tramways.**
BRADFORD CORPORATION. Tenders by Oct. 1.

**Lime.**
COMMERCIAL GAS COMPANY. Tenders by Sept. 23.

**Masonry Dam, Bye-Pass Channels, Cast-Iron Cylinders, &c.**
BRADFORD CORPORATION. Tenders by Oct. 1.

**Office, Store, Shed, &c.**
BRADFORD CORPORATION. Tenders by Oct. 1.

**Pipes and Fittings, &c.**
RHONDDA GAS AND WATER DEPARTMENT. Tenders by Sept. 24.

**Tar and Ammoniacal Liquor.**
BLACKPOOL GAS DEPARTMENT. Tenders by Sept. 26.
GAINSBOROUGH GAS DEPARTMENT. Tenders by Sept. 26.
LLANDUDNO GAS DEPARTMENT. Tenders by Oct. 10.

---

### OXIDE OF IRON.

**O'NEILL'S OXIDE has a larger annual** sale than all other Oxides combined.

**SPENT OXIDE** purchased in any district.

**GAS PURIFICATION & CHEMICAL CO., LD.**

JOHN WM. O'NEILL, Managing Director,

PALMERSTON HOUSE, LONDON, E.C.

---

**WINKELMANN'S**

**"VOLCANIC" FIRE CEMENT.**

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

---

**BROTHERTON & CO., LIMITED.**

Offices: Commercial Buildings, LEEDS. Correspondence invited.

---

**NEW GAS PLANT CEMENT.**

**JOHN E. WILLIAMS AND CO.,**

VICTORIA PAINT WORKS, MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

---

**HYDRATED OXIDE OF IRON.**

**PREPARED from Pure Iron.**

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

---

**PENNY-IN-THE-SLOT WORK.**

**H. GREENE & SONS, Ltd., are prepared** to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.

Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

---

**AMMONIACAL LIQUOR wanted.**

BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

---

**MADAME ALTING-MEES,** Diplomée Paris, Londres, Bruxelles, "LECTURER ON GAS COOKING," is now booking dates for Lectures on the Continent and at home. Would accept a suitable permanent post as Demonstrator.

Write for terms for Lectures and Price of Pamphlet, "La Cuisine au Gaz," to Madame ALTING-MEES, 102, Sinclair Road, Kensington, LONDON, W.

---

**GAS TAR wanted.**

BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

---

**SULPHATE OF AMMONIA**

SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

---

**J. & J. BRADDOCK (Branch of Meters** Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

---

### DUTCH OXIDE OF IRON.

**THE First Dutch Bog Ore Co., Ltd.** (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.

*General Manager (for England and Wales)*—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.

*London Managers*—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.

*General Manager (for Scotland)*—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

---

### SULPHURIC ACID.

**SPECIALLY prepared for the Manu**facture of SULPHATE OF AMMONIA.

SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.

Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

---

**SULPHURIC ACID for Sale.**

BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

---

**AMMONIACAL Liquor wanted by** JOHN RILEY & SONS, Hapton, near ACCRINGTON.

---

**PATENTS AND TRADE MARKS**

PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

---

**ADVERTISER seeks an Appointment** at a Gas-Works in Liverpool or Neighbourhood. Present situation, Secretary and Manager of a small Works—8 millions.

Address No. 4096, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

---

**ADVERTISER seeks re-engagement as** MANAGER of medium sized Gas-Works—from 10 Millions upwards. Thoroughly practical in all departments of Gas-Works, as well as Outside Fitting, Mains, and Stoves. Age 36. Good Testimonials and References.

Address No. 4089, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

---

**STOKERS Wanted, used to Shovel** Charging. Permanent employment for steady, reliable Men. Wages 31s. per week.

Apply to BENJAMIN BARK, Gas-Works, GODALMING.

---

**COAL GAS TAR wanted.**

Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding Scale Basis.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

---

### OXIDE OF IRON.

(NATURAL.)

**BALE & CHURCH will be pleased to** send Samples and Quotations, and make Offers for SPENT OXIDE.

BALE'S FIRE CEMENT, PAINT, AND GAS COAL.

5, CROOKED LANE, LONDON, E.C.

---

**GAS-STOVE TRADE.**

**ADVERTISER (Age 36), 20 Years' first-**class Experience in the Trade—Commercial and Manufacturing—is open to an ENGAGEMENT. Smart, energetic, good organizer, and thoroughly understands control of business.

Address No. 4091, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

---

**FITTER and Smith Wanted, used to the** Routine of a Gas-Works. A qualified Mechanic preferred.

Apply, by letter, stating all Particulars as to previous and present Employments, Age, and Wages required, to No. 4072, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

---

**WANTED, by a large Suburban Gas** Company, a smart Man, well-experienced in Main and Service Laying and General Fitting, to act as ASSISTANT-INSPECTOR. Age not to exceed 30 years. Wages to commence 40s. per week. Age and Experience required with Application. Good opening for a capable Man.

Apply, by letter, to No. 4097, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

---

**WANTED, a Secretary for the Truro** Gas Company, Limited.

Salary to commence at £110 per annum. Age not less than 21 Years.

Applicants must have had experience in a Gas Company's Office, and be able to take up the appointment at an early date.

Applications, to be endorsed "Secretaryship," accompanied by not more than three recent Testimonials, to be sent to the undersigned by noon of the 23rd inst.

By order of the Board,
REGINALD GREENAWAY,
Secretary.

5, Boscawen Street, Truro,
Sept. 10, 1903.

---

**A HIGH-CLASS French Company,** whose Head Offices are in PARIS and who have been engaged for more than 30 Years in the Manufacture of Patented Apparatus of the greatest importance for all Water-Works, desires to find in England an ENGLISH AGENT (who would be paid by Salary and by a Share in the profits) possessing the necessary technical and commercial qualification to introduce and sell their Appliances to Water-Works in the United Kingdom.

Applications, by letter, accompanied by Testimonials and Applicant's Photograph, with the fullest Particulars as to his past Experience and learning (degrees obtained), and previous Occupation—should be addressed to No. 4094, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, immediately, a Stoker.** One used to Shovel Charging, Engine, Exhauster, and Boiler. Permanent employment to a suitable man.
Apply to A. REEVES, Engineer and Manager, Gas-Works, Hythe, KENT.

PRODUCER GAS.

**HEAD Draughtsman Wanted to Take** CHARGE of Producer Department. Must be thoroughly well versed in detail construction of Producer Gas Plant, and able to carry work through from the General Arrangements to the Detail Drawings. Good prospects for a Good Man.
Salary £4 per week.
Applications treated in Confidence.
State Age and Experience to No. 4095, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ASCOT DISTRICT GAS COMPANY.

**WANTED, at once, a thoroughly effi-** cient GENERAL WORKING FOREMAN, who must have full knowledge of the whole routine of a Gas-Works, be a good Carbonizer, and capable of undertaking Repairs, Laying of Mains and Services, and of Controlling Workmen A practical knowledge of the Manufacture of Sulphate of Ammonia would also be desirable.
He must be sober and steady, and able to take entire charge of the Works in the absence of the Manager.
Wages to commence at £2 per week, with House, Gas, and Coals free.
Apply with *copies* of three recent Testimonials, stating present Position and Age, to
A. E. BROOKS,
Manager.
Gas-Works, Sunninghill, Berks.,
Sept. 10, 1903.

**SMALL Gas-Works to Let on Lease, in** growing District and showing good Returns.
Address No. 4093, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**TAR Contracts Wanted on the Sliding-** Scale or at Fixed Prices.
Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

**WANTED, Two lengths of 18-inch** Wrought-Iron ⊃-shaped HYDRAULIC MAIN, for Seven Dip 5-inch Pipes each; Fourteen 5-inch DIP-PIPES; Fourteen 5-inch ARCH-PIPES; Fourteen 6 in. to 5 in. Taper ASCENSION-PIPES, Wrought-Iron BUCKSTAVES, TIE-RODS, and FURNACE FITTINGS for Two Benches of Retorts.
Particulars and Price to R. S. CHURCH, Engineer, Gas-Works, CHICHESTER.

**FOR SALE—A Private Gas-Works** Plant, in splendid condition. May be Inspected by Appointment.
Apply, by letter, to A. G. WEIGALL, Esq., Estate Office, Preston Hall, AYLESFORD.

**TO BE SOLD—Gas Valves (Six Screw)** by Walker, 16 in. diameter; also Six RACK and PINION, by Donkin, same size. Equal to new.
GASHOLDER, 22 feet by 10 feet, with Steel Tank. Self contained.
Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

**GAS PLANT for Sale—I can always offer** NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

**WANTED, Offers for Four Cast-Iron** PURIFIERS, 6 ft. by 6 ft. by 3 ft., Three Tiers of Grids, bolted together in sections, luted 15 in. by 6 in., Covers of ⅜ inch Wrought Iron, with Tie-Rods, &c., which are in good condition. Dry-Face Centre-Valve, 5-inch Connections and Lifting Apparatus complete. Erected by W. C. Holmes & Co. in 1887.
Also for Six 5-inch VALVES and a quantity of 5-inch CONNECTIONS. Will be put free on rails at Draycott, M.R.
Can be seen in use at the DRAYCOTT GAS-WORKS, near Derby, where full Particulars may be obtained.

**THE Gas Committee of the Corporation** of Blackpool are prepared to receive TENDERS for the surplus TAR produced during the next Twelve Months from Sept. 30, 1903.
Tenders to be endorsed and sent to the Chairman by the 26th inst.
By order,
JOHN CHEW,
Gas Engineer.
Gas Office, Princess Street,
Blackpool, Sept. 9, 1903.

BOROUGH OF ROCHDALE.

TO TAR DISTILLERS AND OTHERS.

**THE Gas Committee of the above Cor-** poration invite TENDERS for the supply of 90 per cent. BENZOL for delivery between Oct. 1, 1903, and March 31, 1904.
Tenders, endorsed "Benzol," stating Price per Gallon delivered at the Gas-Works, Dane Street, Rochdale, must be sent in to me not later than noon on Wednesday, Sept. 23, 1903.
By order,
JAMES LEACH,
Town Clerk.
Town Hall, Rochdale,
Sept. 10, 1903.

BRADFORD CORPORATION.

NIDD VALLEY WATER-WORKS.
ANGRAM STORAGE RESERVOIR.

CONTRACT No. 9.

**THE Corporation of Bradford are pre-** pared to receive TENDERS for the construction of a MASONRY DAM (1200 ft. in length by 130 ft. in height above the level of the bed of the River Nidd) at Angram, including Wing Walls, River Walls, Gauge Basin, Waste Channels, Valve Tower, Flood Arches, Roads, &c.
Also Two Miles or thereabouts of BYE-PASS CHANNELS, 9 ft. wide, semi-circular in form, constructed with Concrete and Masonry.
And CAST-IRON CYLINDERS, UPSTAND PIPES, OUTLET VALVES, HEADSTOCKS, FLOATS, GAUGES, WEIRS, and other Works, Apparatus, and Appliances.
Drawings may be seen, and printed copies of Specification and General Conditions, Schedule of Quantities, Form of Tender, with Lithographed copies (reduced) of the more important Drawings, may be obtained at the Office of Mr. James Watson, M.Inst.C.E., Water-Works Engineer, Town Hall, Bradford, on and after Tuesday, the 1st day of September, on payment of the sum of £5, which sum will only be returned on receipt of a *bonâ-fide* Tender and the return of all the documents.
Sealed Tenders, on the form supplied, together with the Conditions of Contract, Specifications, and Schedule of Quantities, &c., must be sent in intact, fully filled up, to the undersigned not later than Ten a.m. on Thursday, the 1st day of October, 1903, endorsed "Angram Reservoir Tender."
An Engineer will meet intending Contractors at Pateley Bridge Station at Ten a.m. on Tuesday, the 8th, Friday the 11th, Wednesday the 16th, and Thursday the 24th of September, and show them over the site of the Works.
The Corporation do not bind themselves to accept the lowest or any Tender.
FREDERICK STEVENS,
Town Clerk.
Town Hall, Bradford,
Aug. 26, 1903.

BRADFORD CORPORATION.

NIDD VALLEY WATER-WORKS.
LIGHT RAILWAYS.

CONTRACTS NOS. 10 AND 11.

**THE Bradford Corporation are pre-** pared to receive TENDERS for the Construction of Thirteen Miles, or thereabouts, of LIGHT RAILWAYS and TRAMWAYS in connection with their intended Angram Storage Reservoir Works.
Plans may be seen, and printed copies of the Specifications, Conditions of Contract, Form of Tender, Schedule of Quantities, &c., may be obtained at the Office of Mr. James Watson, M.Inst.C.E., Water-Works Engineer, Town Hall, Bradford, on and after Tuesday, the 1st day of September, upon payment of £5, which sum will only be returned upon the receipt of a *bonâ-fide* Tender and the return of all the documents.
Sealed Tenders, on the form supplied, together with the Conditions of Contract, Specifications, and Schedule of Quantities, &c., must be sent in intact, fully filled up, to the undersigned not later than Ten a.m. on Thursday, the 1st day of October, 1903, endorsed "Light Railways Tender."
The Corporation do not bind themselves to accept the lowest or any Tender.
FREDERICK STEVENS,
Town Clerk.
Town Hall, Bradford,
Aug. 26, 1903.

BRADFORD CORPORATION.

WATER-WORKS.

COVERED SERVICE RESERVOIRS.

**THE Corporation of Bradford are pre-** pared to receive TENDERS for the Construction of the under-noted SERVICE RESERVOIRS, including Excavations, Embankments, Masonry, Concrete, Brick, Timber, Ironwork, Valve Chambers, Valves, Pipes, Pipe Tracks, Laying and Jointing Pipes, Roads, Gates, Boundary Walls, &c., &c., viz.:—

No. 1 RESERVOIR,

to be erected in the Parish of Clifton, on the north side of Birkby Lane, Hartshead Moor.

No. 2 RESERVOIR,

to be erected in the Parish of Pudsey, on the north side of Owl Cotes Road.

No. 3 RESERVOIR,

to be erected in the Parish of Calverley-with-Farsley, in a field near Holly Park Mills.
The Three Reservoirs are similar in size and construction, and are each 167 ft. by 60 ft. by 12 ft. deep.
Drawings may be seen, and printed copies of Specification and General Conditions, Schedule of Quantities, Form of Tender, with Lithographed copies (reduced) of the more important Drawings, may be obtained at the Office of Mr. James Watson, M.Inst.C.E., Water-Works Engineer, Town Hall, Bradford, on and after Tuesday, the 1st day of September, on payment of the sum of £5, which sum will only be returned on receipt of a *bonâ-fide* Tender and the return of all the documents.
Sealed Tenders, on the Form supplied, together with the Conditions of Contract, Specifications, and Schedule of Quantities, &c., must be sent in intact, fully filled up, to the undersigned not later than Ten a.m. on Thursday, the 1st day of October, 1903, endorsed "Service Reservoir Tender."
The Corporation do not bind themselves to accept the lowest or any Tender.
FREDERICK STEVENS,
Town Clerk.
Town Hall, Bradford,
Aug. 26, 1903.

BRADFORD CORPORATION.

NIDD VALLEY WATER-WORKS.

**THE Corporation of Bradford are pre-** pared to receive TENDERS for the Construction of OFFICE, STORE, SHED, &c., to be erected at Gouthwaite Lodge, near Pateley Bridge.
Plan, Specification, &c., may be seen at the Office of Mr. James Watson, M.Inst.C.E., Town Hall, Bradford, on and after Tuesday, the 1st day of September.
Sealed Tenders must be sent to the undersigned not later than Ten a.m. on Thursday, the 1st day of October, 1903.
The Corporation do not bind themselves to accept the lowest or any Tender.
FREDERICK STEVENS,
Town Clerk.
Town Hall, Bradford,
Aug. 26, 1903.

**THE Llandudno Urban District Council** are prepared to SELL a quantity of Second-hand 3 and 5 Light DRY GAS-METERS at half cost, all of which have been tested, and are in good repair.
Offers to be sent to the undersigned on or before the 22nd inst.
(Signed) E. PALEY STEPHENSON, Assoc.M.Inst.C.E.
Engineer and Surveyor to the Council.
Town Hall, Llandudno,
Sept. 11, 1903.

**THE Llandudno Urban District Council** invite TENDERS for the purchase of surplus AMMONIACAL LIQUOR and TAR to be made during a period of Twelve Months next ensuing.
Tenders to be sent in to the undersigned on or before the 10th day of October next, endorsed "Liquor and Tar."
(Signed) ALFRED CONOLLY,
Clerk to the Council.
Town Hall, Llandudno,
Sept. 10, 1903.

BREEZE.

**THE Directors of the Commercial Gas** Company are prepared to receive TENDERS for the surplus BREEZE produced at their several Works for the Twelve Months ending the 30th of September, 1904.
The quantities are estimated to be as under; but the same cannot be guaranteed, and may be more or less:—
At the Stepney Works on the Regent's Canal—
1000 chaldrons (of 18 Cwt.) of Fine Coke Breeze.
At the Wapping Works on the River Thames—
2200 chaldrons (of 18 Cwt.) of Fine Coke Breeze.
At the Poplar Works in Bow Creek (free waterway)—
5000 chaldrons (of 18 Cwt.) of Fine Coke Breeze.
The Tenders may be for the whole or for One or more Works separately.
The Contractors must give Security to remove the Breeze as it accumulates, to pay for the same monthly, and generally for the due fulfilment of the Contract.
The Form of Agreement to be signed can be seen at the Company's Offices.
Tenders, sealed and endorsed "Tender for Breeze," to be delivered here not later than the 23rd inst.
The Directors reserve to themselves the right to accept any Tender in part or in whole, and do not bind themselves to accept the highest or any Tender.
Commercial Gas-Works,
Stepney, E., Sept. 10, 1903.

LIME.

**THE Directors of the Commercial Gas** Company will be prepared to receive TENDERS, not later than the 23rd inst., for the supply of WHITE FLARE BURNT CHALK LIME to their Stepney, Wapping, and Poplar Works over the Twelve Months ending the 30th of September, 1904.
Particulars may be obtained from the Engineer at the Offices of the Company, Stepney, E.
The Directors reserve to themselves the right to accept any Tender in part or in whole, and do not bind themselves to accept the highest or any Tender.
Commercial Gas-Works,
Stepney, E., Sept. 10, 1903.

CARBON.

**THE Directors of the Commercial Gas** Company are prepared to receive TENDERS not later than the 23rd inst., for RETORT CARBON over Twelve Months, from the 30th of September, 1903, estimated at the following quantities:—
At the Stepney Works on the Regent's Canal, 35 Tons.
At the Wapping Works on the River Thames, 100 Tons.
At the Poplar Works on Bow Creek (free waterway), 140 Tons.
The Directors reserve to themselves the right to accept any Tender in part or in whole, and do not bind themselves to accept the highest or any Tender.
Commercial Gas-Works,
Stepney, E., Sept. 10, 1903.

BOROUGH OF BARROW-IN-FURNESS.

SUPPLY OF GAS OIL.

**THE Corporation are prepared to** receive TENDERS for the supply of about 300 Tons of OIL suitable for the Manufacture of Carburetted Water Gas, delivered free at the Gas-Works Siding, in such quantities and at such times as may be required during the period ending the 30th of June, 1904.
Sealed Tenders, addressed to the Chairman of the "Gas and Water Committee," and endorsed "Tender for Oil," to be delivered at the Town Clerk's Office not later than Twelve o'clock noon on Wednesday, the 23rd of September, 1903.
The lowest or any Tender not necessarily accepted.
By order,
C. F. PRESTON,
Town Clerk
Town Hall, Barrow-in-Furness,
Sept. 1, 1903.

# R. & J. DEMPSTER

LIMITED,

SOLE OWNERS OF

Patented
Improved

# 'Spiral-Guided Gasholders,'

**INVITE** the careful attention of Engineers who desire to keep down Capital expenditure to the many advantages possessed by these improved Gasholders.

**Upwards of 150** are at work of all sizes up to 150 feet in diameter, with one, two, and three lifts.

In **Eighteen** cases **repeat orders** have been given—a proof that they are appreciated and are satisfactory.

With DEMPSTER'S patented improvements, Spiral-Guided Gasholders have risen superior to criticism, while experience has proved them to be the **strongest and safest.**

They embody every useful advance made in Gasholder Building during the past century, and while careless construction is impossible, they are **cheaper** than guide-framed Gasholders.

They may be painted from the top of the tank and kept in perfect order at low cost, and **no expense** is incurred in painting the usual guide-framing.

**All** the guide rails and plates are **external**, made of English steel, and **do not require renewing.**

The guide rollers are fixed upon the dip of Holder, or coping of tank, and are **always accessible.** They are easily lubricated when required, and the wear and tear is practically *nil.*

The difficulty of **guiding shallow Gasholders** of any diameter is **perfectly** overcome by this System, and this is a valuable feature if a tank has to be constructed in bad ground.

---

For Estimates and further Information apply to the Makers at the Gas Plant Works, Oldham Road, Manchester.

---

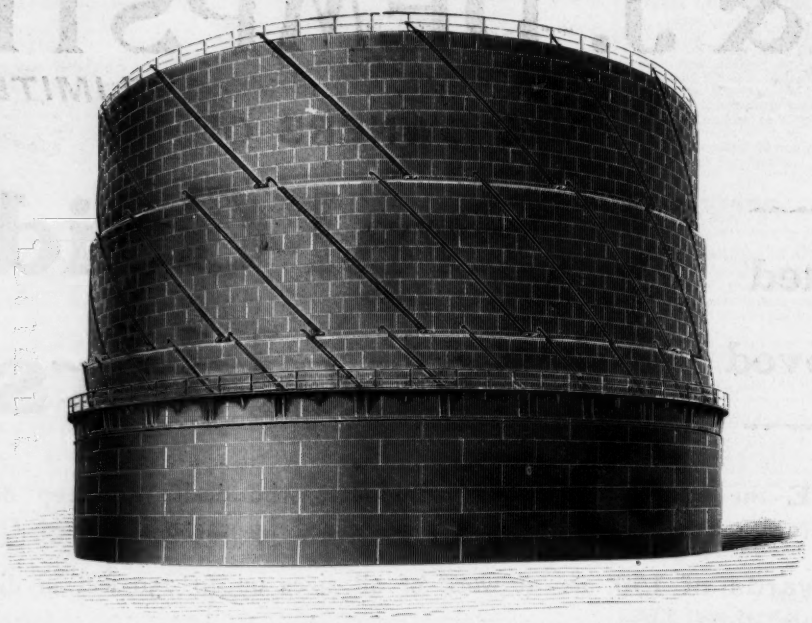
LONDON OFFICE:

## 165, GRESHAM HOUSE, OLD BROAD STREET, E.C.

TELEGRAMS: "SCRUBBER," MANCHESTER.

P.T.O.

# R. & J. DEMPSTER, LTD.



Improved Three-Lift Spiral-Guided Gasholder in Steel Tank, 152 ft. 6 in. dia. by 30 ft. 9 in. deep.

## Extracts from Testimonials.

"During the gale of last Sunday (20/1/01), the Holder was full to within one-and-a-half plates and behaved splendidly. As soon as the gale strikes the Holder, it comes to its bearings on the guides, and remains perfectly steady under the wind pressure."

"I use your first Gadd and Mason's Holder as a reserve, and during the winter it is almost always full night and day. It was at the full height and stood quite unmoved. Such a gale has not been experienced for many years."

"There is not the slightest 'dancing' such as we are accustomed to with vertically guided gasholders."

"I consider that DEMPSTER'S Improved Rail and the Outside Guiding is a marked improvement on the old type, and that it thoroughly carries out all the designers state."

"During the summer this town was visited by a severe typhoon, lasting three days. The peculiarity of our typhoon is that the winds seem to come in tremendous gusts from varying directions. They test the stability of any structure, and you will be glad to hear that your Spiral-Guided Gasholder stood the trial admirably. It was inflated well up in the second lift, and there was no visible movement. This is extremely gratifying to me after advising my Board to adopt your type."

"It is undoubtedly another addition to your previous successes in Spiral-Guided Holders."

"These gales have been the severest that we have ever experienced, and yet the Gasholder moved up and down with the greatest ease. I hardly think it possible we could have greater wind pressure, and do not think that any other Spiral-Guided Gasholder has had such a severe test as ours."

"I shall recommend my Directors to adopt the same principle for the large new Gasholder we have in contemplation."

"Although our Holder is in a very exposed position, during the gales it was as steady as a rock."

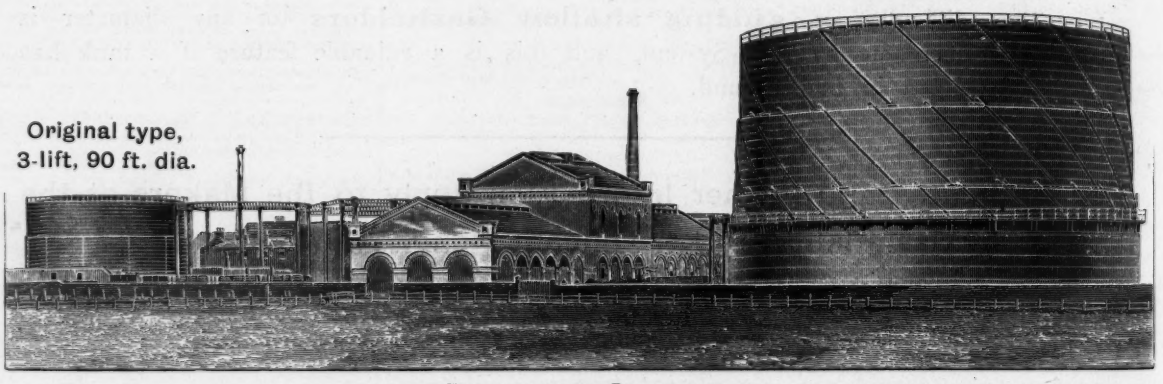
"Your Gasholder is working to my satisfaction, having been thoroughly tested with the late frost and gales. During the tempest, it was inspected by us and was quite stable, and had less vibration than our other Holder with girders and columns."

"In common with other parts of the country, we have been visited with terrific gales and snow storms; the snow drifted on the crown, yet the Holder was not in any way affected."

"Your Holder is perfectly steady and gives no variation in pressure during the stiffest gales. I wish I could say the same of my other Holders"

Dempster's Improved Spiral-Guided 3-lift Gasholder.

Original type, 3-lift, 90 ft. dia.



Engraved from a Photograph.

## GAS PLANT WORKS, OLDHAM ROAD, MANCHESTER.

Fig. 1

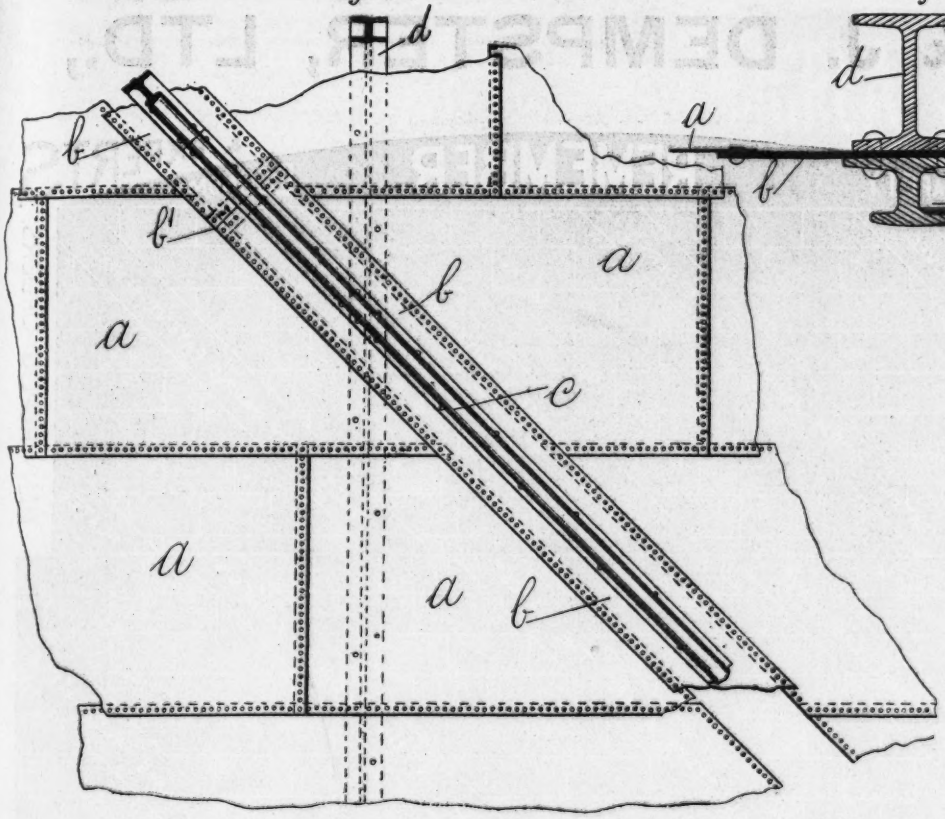
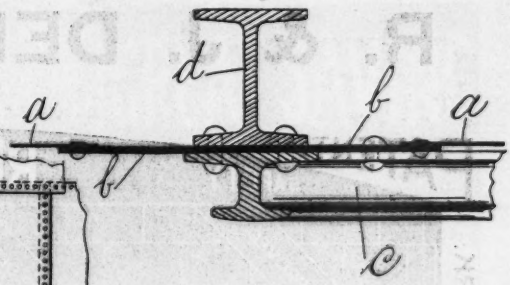



Fig. 2.




## Extracts from the Patent Specification.

### "IMPROVEMENTS IN GASHOLDERS."

The Improvements relate to gasholders generally, and are especially applicable to holders without upper guide-framing, which are guided and supported in their working position by means of spiral rails attached to the face of the holder; and the object of the improvements is to facilitate the fixing of such spiral rails upon the holder, **and to give greater security thereto.**

To accomplish this, the holder is constructed at those parts where it is intended to attach the guide rails, with plates placed **diagonally, or spirally,** in lieu of vertically or horizontally; **such spiral plates being riveted,** or otherwise connected, **to the adjacent and ordinary plates of the gasholder,** in manner as will be well understood.

These diagonal or spiral plates are, by preference, **of greater thickness** than the plates forming the main body of the gasholder, by which means, **greater strength is obtained at those parts where the strain of guidance and support is applied,** without increasing the weight of the structure to an undesirable extent; **and the shell of the gasholder is materially strengthened thereby.**

The spiral plates are also, preferentially, of considerable length in proportion to their width; and, in some cases, it may be that one such plate extends from top to bottom of the lift of a gasholder; so that the spiral guide may have a **level bearing throughout its entire length upon the spiral plate.** Where the depth of the gasholder will not allow of this being carried out, the ends of the spiral plates will butt together, and the joint be formed with a cover plate on the inside of the gasholder; **thus making the spiral plate flush throughout,** obviating the necessity of lap joints. The guide rail is bent to the curve of the gasholder, both **vertically and laterally,** and is thereby brought into **absolute contact its entire length, and is secured to the spiral plate with rivets;** thus ensuring a **perfect joint.** This prevents the **rusting or corroding of the iron behind the guide** caused through the water trickling down the sheeting.

But that the invention may be better understood, the accompanying drawings more fully describe the means employed.

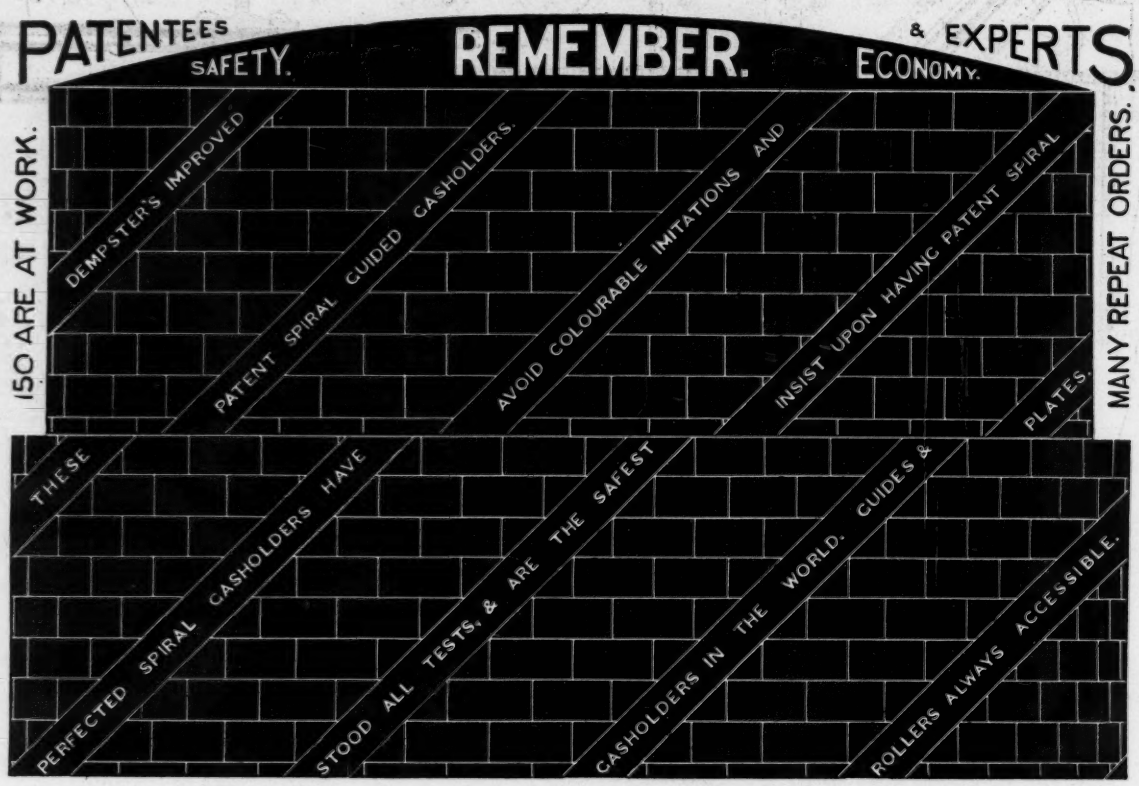
Fig. 1 shows a part of a gasholder, with spiral rail and rail-plates according to the patented improvements; and Fig. 2 shows a cross section of such rail and plates on an increased scale.

*a a* are the ordinary plates of the holder; *b* are the diagonal or spiral plates, attached to the plates *a* by rivets, or otherwise, and jointed as at $b^1$, in any convenient manner; or it may be formed in one length, and without such joint. *c* is a spiral guide rail, connected by any convenient means to the plates *b*. *d* is an ordinary upright stay or stiffening rail.

Variations in detail may be made, such as in the number, dimensions, and material of the diagonal or spiral plates, and in the method of attaching them to the main plates, or of connecting the guide rails thereto, without departing from the peculiar character of the invention.

P.T.O.

# R. & J. DEMPSTER, LTD.,




"YOUR SPIRAL HOLDER STANDS LIKE A ROCK."

## R. & J. DEMPSTER, LTD., MANCHESTER.

HAVING acquired experience in the erection and working of upwards of one hundred and twenty-five Columnless Gasholders, and practically tested all the details to secure the best in every respect, will be pleased to advise upon the construction and working of any size of Gasholder upon the Spiral Guided System. They are also prepared to grant a License to any Gas Company or Corporation who will adopt their Improved Patent upon reasonable terms.

Much prejudice has been created against Spiral Guided Gasholders owing to the mistaken policy of those who have adopted the Columnless type, without the safeguards pointed out by the original patentees and the improvements dictated by practical experience. Still the testimony of users, the repetition of orders, and, in recent times, the eagerness of competitors to participate in a successful business, all speak powerfully in favour of the most solid and economical improvement in Gasholder Construction ever devised. As an aid to secure cheap gas, improved Spiral Guided Gasholders are a distinct advantage both in capital cost and annual up-keep. But they must not be compared with Gossamer holders and yielding guide framing, which are often offered in competition with the stronger and safer Spiral holder. The maximum of strength together with the greatest storage on a given site for the least amount of money can be secured by consulting the above

## Gas Plant Contractors,

Who also make a speciality of Cast Iron and Steel Tanks for all kinds of storage.

Printed for Walter King by King, Sell, & Olding, Ltd.; and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Sept. 15, 1908.

P.T.O.

THE Bridgewater Trustees are prepared to receive TENDERS for the LIGHT OIL produced at their Coke-Works for a period of Three, Six, or Twelve Months from the 1st of October next, delivered into Contractor's Tanks at the Trustees' Brackley Siding, on the Little Hulton Mineral Branch of the L. & N.W. Rly.; or their Wharton Hall Siding, on the Pendleton and Hindley Branch of the L. & Y. Rly.

Tenders, endorsed "Tender for Light Oil," to be addressed to the BRIDGEWATER TRUSTEES 4, Chapel Walks, MANCHESTER, on or before the 21st of September.

**BOROUGH OF COLNE.**

THE Gas Committee invite Tenders for the surplus COKE made at their Gas-Works (estimated quantity 2100 Tons), to be removed between Oct. 1, 1903, and March 31, 1904.

Particulars may be obtained from the undersigned.

The Gas Committee do not bind themselves to accept the highest or any Tender.

Sealed Tenders, endorsed "Coke," to be addressed to the Chairman of the Gas Committee, and delivered at the Gas-Works not later than noon on Friday, Sept. 18, 1903.

FRED THORPE,
Engineer and Manager.

Gas-Works, Colne (Lancs.),
Sept. 5, 1903.

**GAINSBOROUGH URBAN DISTRICT COUNCIL.**
(GAS DEPARTMENT.)

TENDERS FOR TAR.

THE Gas Committee of the above Council are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works for a period of Twelve Months from Oct. 1, 1903.

Probable quantity, 450 Tons.

Further Particulars may be obtained on application to the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, must be delivered at the Gas-Works not later than Sept. 26, 1903.

The Committee do not bind themselves to accept the highest or any Tender.

JOHN BALDWIN,
Manager.

Gas-Works, Gainsborough,
Sept. 9, 1903.

**RHONDDA URBAN DISTRICT COUNCIL.**
(GAS AND WATER DEPARTMENT.)

THE above Council are prepared to receive TENDERS for the supply of WROUGHT-IRON TUBES and FITTINGS, LEAD, COMPO. PIPES, and BLOCK TIN.

Further Particulars and Forms of Tender may be obtained on application to the Engineer and Manager (Mr. Octavius Thomas), Gas and Water Offices, Pentre, R.S.O., Glam.

No Form of Tender other than that issued by the Council will be accepted.

The Contractors will be required to pay the Standard rate of Wages recognized in the District.

Tenders, endorsed "Contract No. 7 or 8" as the case may be, addressed to the Chairman of the Gas and Water Committee, to be sent to the undersigned on or before Ten a.m. on Thursday, the 24th inst.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER P. NICHOLAS,
Clerk.

Council Offices,
Pentre, R.S.O., Glam.,
Sept. 11, 1903.

**BRITISH GASLIGHT COMPANY, LIMITED.**

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 30th inst., at Twelve o'clock precisely, to transact the usual Business, and to declare a Dividend for the Half Year ended the 30th of June last.

Notice is Hereby also Given, that the TRANSFER BOOKS of the Company WILL BE CLOSED on the 19th and RE-OPENED on the 1st of October.

By order of the Court of Directors,
H. B. CHAMBERLAIN,
Secretary.

Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
Sept. 9, 1903.

JUST OUT. *With Diagrams and Illustrations. Price 5s. net.*

**ACETYLENE:**
**The Principles of its Generation and Use,**

By F. H. LEEDS, F.I.C., F.C.S., Member of the Society of Public Analysts and of the Acetylene Association, and W. J. ATKINSON BUTTERFIELD, M.A., F.I.C., F.C.S., Consulting Chemist, Author of "The Chemistry of Gas Manufacture."

GENERAL CONTENTS.—Introductory—Advantages of Acetylene—Chemistry and Physics—General Principles of Generation—Choice of a Generator—Statutory Regulations—Treatment after Generation—General Properties—Mains and Service-Pipes—Subsidiary Apparatus—Burners—Heating Apparatus and Motors—Carburetted, Compressed, and Dissolved Acetylene—Mixtures—Acetylene Lamps—Valuation and Analysis—Index.

"A well written volume. . . . Brimful of Information."—*Chemical Trade Journal.*

JUST OUT. *With Four Folding Plates and numerous Illustrations. Large 8vo. Price 8s. 6d. net.*

**WATER SUPPLY:**

A Practical Treatise on the Selection of Sources and the Distribution of Water. By REGINALD E. MIDDLETON, M.Inst.C.E., M.Inst.Mech.E., F.S.I.

ABRIDGED CONTENTS—Introductory—Requirements as to Quality—Requirements as to Quantity—Storage Reservoirs—Purification—Surface Reservoirs—The Flow of Water through Pipes—Distributing System—Pumping Machines—Special Requirements—Index.

LONDON: CHARLES GRIFFIN, and Co., LTD., EXETER STREET, STRAND.

**ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.**

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

**BATTERSEA POLYTECHNIC, S.W.**

*Principal:* S. H. WELLS, A.M.Inst.C.E., A.M.Inst.M.E.
CHEMICAL DEPARTMENT.
*Head of Department:* JOHN WILSON, M.Sc.
Session 1903-4. Commencing Sept. 28, 1903.
GAS MANUFACTURE.

TWO Courses of Evening Lectures, with Laboratory Work:—
(1) Ordinary Grade. (2) Honours Grade.
Will be given by Mr. J. G. Taplay (Gaslight and Coke Company) on Tuesday and Thursday Evenings, respectively, in preparation for the City and Guilds Examinations in Gas Manufacture.

GAS ANALYSIS.

Students can enter for complete courses in Gas Analysis on Monday, Tuesday, Wednesday, or Friday Evenings. Also Special Summer Course in Gas Analysis on Wednesday Evenings, commencing May 18, 1904.

Abridged Prospectus free on application. Detailed Prospectus 1d., post free 3d.

**ROBERT MARSHALL,**
**CANNEL COAL MERCHANT,**
**97, WELLINGTON STREET, GLASGOW.**

*Prices and Analysis of all the Scotch Cannels on Application.*

**Asbestos**

If you want
**ASBESTOS CLOTHS**
**Fine, Medium, Coarse.**
really worth the name, you must come to us.
Warranted absolutely pure. Ask for No. 2 Catalogue. Gas-Fire Fuel.

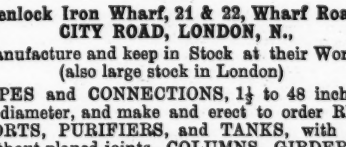
Applications for Colonial & Foreign Agencies invited.

**CRESSWELL'S ASBESTOS CO., LTD.,**
**Wellington Mills, BRADFORD, Yorks.**
*Telephone* 950. *Telegrams:* "*Asbestos, Bradford.*"

**THE PERFECT MANTLE COY.,**
**1c, Aldgate Avenue, London, E.C.**

MANUFACTURERS OF THE WELL-KNOWN

**SUPERIOR "PERMCO"**
MANTLE, IN COTTON AND RAMIE.




Under Welsbach Licence. Can be used legally with any Burner.

**Trade Price 26s. 6d. per Gross.**

**Reduction for Quantities.**

**JAMES OAKES & CO.,**
**ALFRETON IRON-WORKS, DERBYSHIRE,**
AND
**Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,**

**Manufacture and keep in Stock at their Works (also large stock in London)**

**PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.**

**NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.**

**GREAT SAVING IN FUEL**

"AVERY SIMPLE & INGENIOUS APPARATUS."—
VIDE "THE ENGINEER" NOV 17TH 1897

SOLE LICENSEES:
**WALLACH BROTHERS.**
57 GRACECHURCH ST LONDON.E.C

**The "Evertrusty" Draught Indicator, also known as Jensen's Flutometer** (Regd. Trade Mark), Should be fixed to every boiler flue, coke-oven, retort &c., to reduce your Coal Bill. Clear indication of variation of draught pressure obtained. Agents Wanted.

**THE PETROLEUM GAS SYNDICATE**

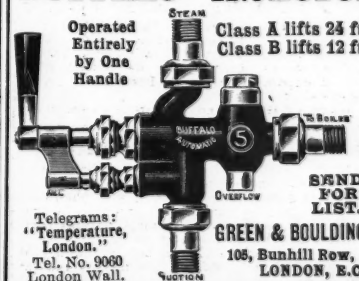
Supply and erect Complete Installations of their
**PETROGENE PATENT GAS PLANT**
**On SALE, HIRE, or ROYALTY.**

**PETROGENE GAS** is the most suitable Illuminant for all Towns, Villages, Factories, Institutions, &c., where a Cheap and Efficient Lighting System is required. It is equally suitable for Heating and Power purposes, and may be used with ordinary Gas Fittings, Stoves, Engines, &c. It may also be used in conjunction with Coal Gas, and affords Gas Companies a ready means of increasing their output without the expense of additional storage.

The Syndicate is prepared to entertain offers of sal of small Gas-Works, whether profit earning or not.

*Offices:* **28, Victoria St., Westminster.**
*Works:* **10, Rochester Row, S.W.**

**'BUFFALO' INJECTOR**




Operated Entirely by One Handle

Class A lifts 24 ft.
Class B lifts 12 ft.

SEND FOR LIST.

Telegrams: "Temperature, London."
Tel. No. 9060 London Wall.

**GREEN & BOULDING,**
**105, Bunhill Row, LONDON, E.C.**

**WELDON MUD**
FOR
**GAS PURIFICATION,**
**For use in the**
**RECOVERY OF SULPHUR,**
**Also Removal of last Traces of**
SULPHURETTED HYDROGEN
**in catch position.**

**Full Particulars on application to the Patentees:**
**GAS DESULPHURIZATION CO.,**
— LIMITED, —
**1, FENCHURCH AVENUE, LONDON, E.C.**

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
*Inquiries Solicited.*
Telegrams: "DARWINIAN, MANCHESTER." Telephone 1806.

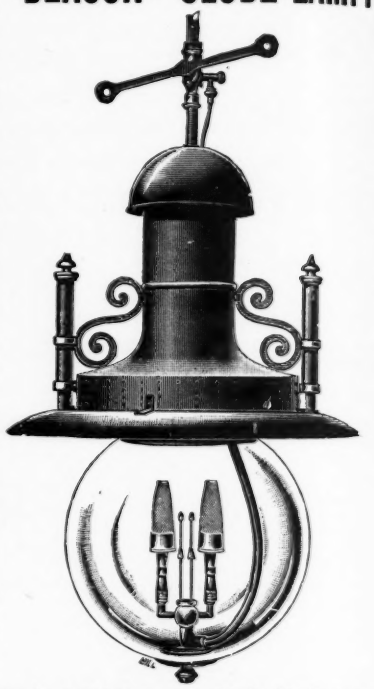
JOHN HALL & CO.,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD.
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY, LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THE "ROTARY" STATION METER.
Efficiency Demonstrated.
*APPLY—*
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE, MANCHESTER.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

THE PATENT
"BEACON" GLOBE LAMP.

Largely adopted by many Local Authorities for Public Lighting, being absolutely Shadowless and Wind-proof.
H. GREENE & SONS, Limited,
Surrey Engineering Works,
Blackfriars Road, LONDON.
Telephone 1693 HOP.
Telegrams: "LUMINOSITY LONDON."

1 Cubic Metre of Gas per 0·5 Kilogramme of Coke!
Both Oil-Carburetted & Benzol-Carburetted Water Gas in the same Generator.

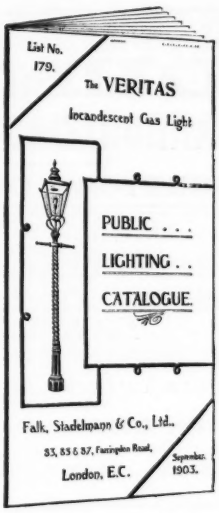
CARBURETTED
WATER-GAS PLANT
(STRACHE SYSTEM).

*For Prices and full Particulars, apply to the*
Internationale Wassergas A.G., Vienna, Austria.
Telegrams: "STRACHEGAS, VIENNA."

**A Contribution to the Attack on Darkness,**

with suggestions.

WE present to gas companies and lighting authorities this volume, just published.




FALK. STADELMANN & Co., Ltd.
*Veritas Lamp Works,*
83, 85, & 87, FARRINGDON ROAD,
LONDON, E.C.

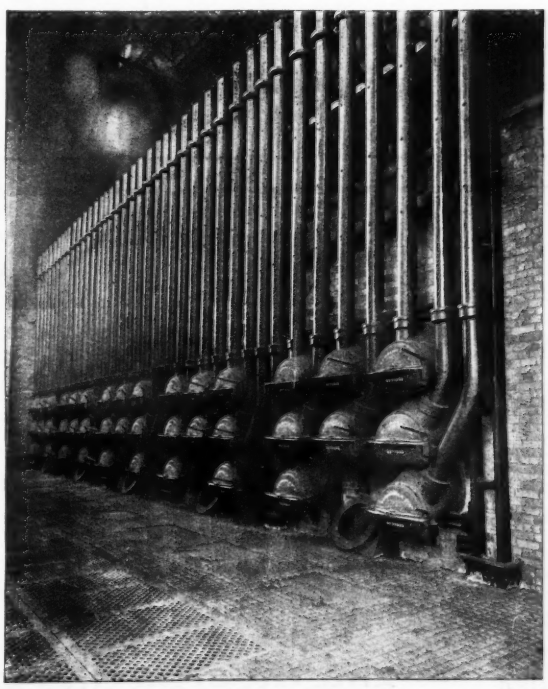
# INCLINED RETORTS.

**WE**

make every single part of the Installation in our own Works at

**RETFORD,**

Including the Roofs, Coal Tippers, Coal Breakers, Coal Elevators, Coal Conveyors, Hot Coke Conveyors and Screening Plants, Retort Mouthpieces with Self-Sealing Lids, Stage Floors, Foul and Hydraulic Mains, Ascension, Arch, and Dip Pipes, &c., &c.



**WE**

only buy the Bricks and Raw Material. So under these conditions we have gained a

**REPUTATION**

for nothing but the Highest Class of Work, as can be seen in our Illustrations at Smethwick, Leek, Liverpool, Malvern, Shipley, &c., &c.

**W. J. JENKINS & CO., Ltd., RETFORD.**

**UNEQUALLED.**

Gas Companies are solicited to try Samples of the

**MIRFIELD**

**BLACK BED GAS COAL.**

*Prices and Analysis on application.*

MIRFIELD (GAS-COAL) COLLIERY COMPY

RAVENSTHORPE, NEAR DEWSBURY.

**TROTTER, HAINES, & CORBETT,** LIMITED,

Brettell's Estate

**FIRE-CLAY & BRICK WORKS,**

**STOURBRIDGE.**

Manufacturers of GAS-RETORTS GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 84, OLD BROAD STREET, E.C.

**HEATHCOTE GAS COAL,**

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

**THE GRASSMOOR CO., LD.,**

**CHESTERFIELD.**

# F. C. SUGDEN & Co.

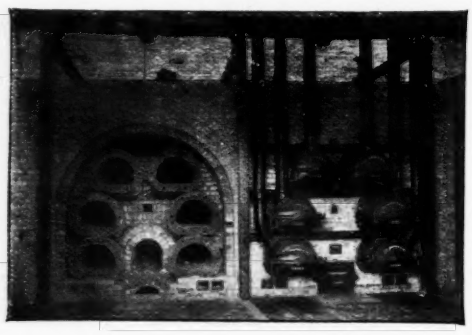


PHOTO. OF REGENERATOR SETTINGS DURING CONSTRUCTION.

**CARBONIZING SPECIALISTS.**

**REGENERATOR & GENERATOR SETTINGS**

DEEP, SEMI-DEEP, AND SHALLOW.

Maximum Make per Ton and Mouthpiece.

Minimum Fuel Consumption.

NUMEROUS REPEAT ORDERS

Have been received for each of the above types of Settings.

RESULTS GUARANTEED. RETORTS RESET.

SOLE MAKERS OF **CRIPPS' PATENT CHIMNEY.**

Designs and Estimates on application. 28, EAST PARADE, **LEEDS.**

**HARRIS & PEARSON,**

**STOURBRIDGE, ENGLAND**

MANUFACTURERS OF

**FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.**

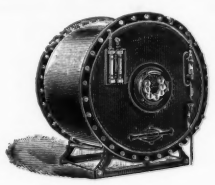
GLAZED BRICKS AND PORCELAIN BATHS.

**JAMES MILNE & SON, LTD.,**

**GAS ENGINEERS**

MILTON HOUSE WORKS EDINBURGH.

LONDON. —— LEEDS. —— GLASGOW.



Over 400 recently Supplied to the Corporation Gas Department, Saltley, Birmingham.

*Telegraphic Address:* "Motive, Birmingham."

**MOUTHPIECES**

FOR

**Inclined and Ordinary Retorts,**

**GRICE'S**

**SPECIAL FASTENINGS.**

**WILLIAM GRICE & SONS, Ltd.,**

**Engineers & Gas-Engine Makers,**

**BIRMINGHAM.**

London Office: 25, Victoria St., Westminster. Mr. A. B. Coote, Representative.

Published Weekly

THE LUCAS LIGHT RECORDER

Issued in the interests of the Gas Industry and the finest high-power Gas Lamp known

Price 0d

*No. 8.*] [*Tuesday, September 1, 1903.*

## Evidence

There are many kinds of evidence known, all of which are essential to the building up of an unassailable case. Where Lamps are concerned, evidence of their merits or demerits may be grouped as follows: 1. Scientific (theoretic) evidence; 2. Experimental evidence through independent Engineers and other Users; 3. Evidence of popular appreciation; 4. Practical evidence of sale returns; 5. Circumstantial evidence.

As to the first point, the facts *re* the Lucas Light are familiar to every reader of these lines, and we need not emphasize the importance of the scientific achievement which is known to the world under that name.

In regard to the second point, we take the opportunity of quoting two out of the many opinions which have been offered to Messrs. MOFFATS, LIMITED (of 155, Farringdon Road, E.C.).

Mr. HAROLD E. COPP, Gas Engineer, of West Bromwich, says:

> The general opinion seems to be that they give a better Light than their rivals, the High-Power . . . . Arc Lamps. There can be no question that the light from the Lucas Lamp carries a much greater distance than that from the Arcs.

Messrs. DAISH & Co., of "The Peacock," Islington, N., until recently staunch believers in Electric Lighting, write:

> In reply to your enquiry *re* comparative cost of running your Lucas Gas Lamps as against our recent (Electric) installation, the saving is enormous, and we have much more light.

*(Continued in No. 9.)*

SAML. CUTLER & SONS, MILLWALL, LONDON.

GASHOLDERS OF EVERY DESCRIPTION.

CUTLER'S PATENT GUIDE FRAME FOR GASHOLDERS

Adopted for many large and important Gasholders.

CUTLER'S PATENT FREEZING PREVENTER

FOR GASHOLDER CUPS AND TANKS.

In extensive use in English, Continental, and American Works.

LARGE STEEL TANKS A SPECIALITY

*Gasworks Plant of every kind.*

# COAL TAR PRODUCTS.

**Benzol, Toluol, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Crude Creosote Salts, Granulated (Crude) Naphthalene, Sublimed Naphthalene, Anthracene, Refined Tar, Pitch.**

For Prices apply to the **SOUTH METROPOLITAN GAS COMPANY,**

Works: ORDNANCE WHARF, EAST GREENWICH, LONDON, S.E.

**709, OLD KENT ROAD, LONDON, S.E.**

Telegraphic Address: "METROGAS, LONDON."

# MOBBERLEY & PERRY,

GAS RETORT, FIRECLAY, AND BRICK WORKS,

**STOURBRIDGE.**

## INCLINED RETORTS A SPECIALITY.

HORIZONTAL AND SEGMENTAL RETORTS.

BEST QUALITY OF FIRECLAY GOODS.

## SPECIALS FOR WATER GAS PLANTS.

**Chequer Bricks always in Stock.**

Telephone No. 103. Telegraphic Address: "ELEVATOR, HASLINGDEN."

# S. S. STOTT & CO.,

ENGINEERS, HASLINGDEN, NR. MANCHESTER.

**COAL AND COKE ELEVATORS & CONVEYORS.**

**COAL AND COKE STORAGE PLANTS.**

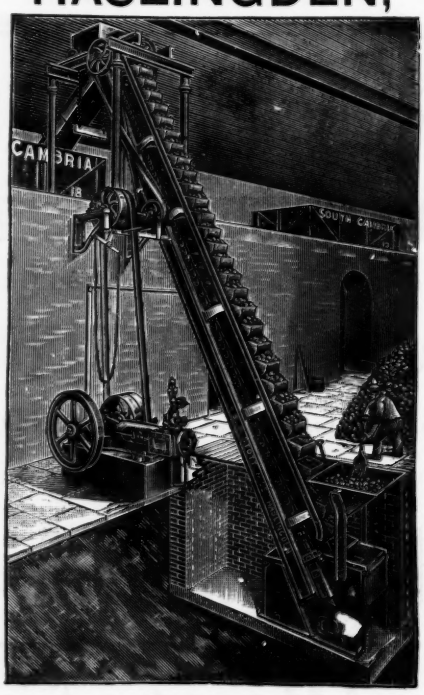
**COAL AND COKE BREAKERS.**

**WHARF ELEVATORS FOR UNLOADING BARGES.**

**ELEVATORS & CONVEYORS for BOILER-HOUSES.**

**STAMPED AND RIVETED STEEL ELEVATOR BUCKETS.**

**DETACHABLE CHAINS AND SPROCKET WHEELS.**



Coke Elevator Loading Railway Waggons.

**LIME AND OXIDE ELEVATORS & CONVEYORS.**

**HIGH-CLASS STEAM-ENGINES up to 1000-Horse Power.**

**PUMPS, HORIZONTAL AND VERTICAL, SINGLE, DOUBLE, or THREE-THROW, for WATER-WORKS, &c.**

**BEAM PUMPING-ENGINES.**

**AIR-COMPRESSORS.**

**BELT PULLEYS, ROPE PULLEYS, GEARING, &c., &c.**

# BIGGS, WALL, & Co.

**13, CROSS STREET, FINSBURY PAVEMENT, LONDON, E.C.**

**Telegrams: "RAGOUT, LONDON." Telephone 273 CENTRAL.**

# METHANE-HYDROGEN WATER-GAS PLANT.

**3 gallons Tar and 20 lbs. Coke produce 1000 cubic feet 10 to 12 Candle Power Gas of the following composition—**

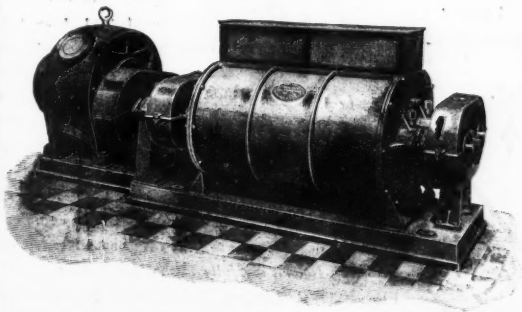
| | |
|---|---|
| Hydrogen | 64·4 per cent. |
| Methane | 12·0 „ „ |
| Unsaturated Hydrocarbons | 3·0 „ „ |
| Carbon Monoxide | 15·0 „ „ |
| Nitrogen and Carbon Dioxide | 5·6 „ „ |
| | 100·0 |
| Calorific Value | 400 B.T.U. |

See **Prof. VIVIAN B. LEWES'S** Lecture before Society of Arts, reported in the "JOURNAL OF GAS LIGHTING," Dec. 9, 1902.

# THWAITES BROS., LD.,

## MECHANICAL ENGINEERS,

## *BRADFORD.*



# ROOTS' BLOWERS

IN ALL SIZES TO DELIVER UP TO

**25,000 cubic feet of Air per minute.**

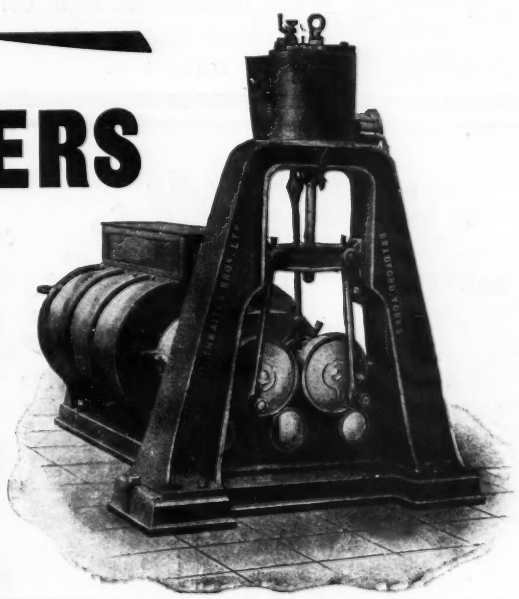
*Driven by Engine, Belt, or Motor.*

SPECIALLY DESIGNED AND OF

MODERN CONSTRUCTION

. . For all Processes of . .

**GAS MANUFACTURE.**



## STEEL SCOOPS
FOR
## RETORT CHARGING.
Scoops supplied with or without handles, and of any dimensions or shape required.

**HENRY SYKES, Ltd., Engineers,**
**66, BANKSIDE, LONDON, S.E.** Telephone No. 565 HOP.

## THE EXPORT MANTLE
SUPPLIED TO **180** GAS COMPANIES.
**Illuminating Power 80 to 700 Candles.**
EXPORT MANTLES, 27/- PER GROSS.
EXPORT REMA SILK MANTLES.
EXPORT HIGH-PRESSURE MANTLES.
*Special Quotation for Large Quantities.*
MANTLES MADE to COMPANY'S own PRESCRIPTION.
Special low Quotations with their own Labels and Stamps.
Burners of all descriptions, solid Brass, from **1/9** per dozen.

**NEW EXPORT INCANDESCENT LIGHTING CO., LTD.,**
**36 MANSELL STREET, LONDON, E.C.**
Telephone No. 4946 Central.
Telegraphic Address: "Export Mansell Street, London."

## THE THAMES BANK IRON CO.
**UPPER GROUND STREET, LONDON, S.E.**
SUPPLY FROM STOCK
**CAST-IRON RETORTS**
**AND ALL KINDS OF GAS-WORKS APPARATUS.**
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of **LYON'S "PATENT" GAS-MAIN SYPHONS.**
AGENTS FOR
*ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.*

**"BRIGHT"**
## Incandescent Mantles.
**Best and Strongest Mantles in the World.**
**27s. PER GROSS.**
*Special Quotations for large quantities.*
— THE —
**Bright Incandescent Light Co.**
**161, Stoke Newington Road,**
LONDON, N.

## CASES FOR BINDING
**QUARTERLY**
## VOLUMES OF THE "JOURNAL"
*PRICE 2s. EACH.*

## HARPER & MOORES, Limited,
**STOURBRIDGE.**
MANUFACTURERS OF
**Inclined, Horizontal, and Segmental**
## GAS-RETORTS,
**Fire-Bricks, Fire-Clay Lumps, and Tiles**
OF EVERY DESCRIPTION.
*Also Manufacturers of* **Cast-Iron Retorts, Iron Mouthpieces, Pipes, and all necessaries for Gas-Works requirements.**
**Telegraphic Address: "MOORES, LYE." Telephone No. 23 Lye.**

## JOSEPH CLIFF & SONS
INCORPORATED IN
**THE LEEDS FIRE-CLAY COMPANY, Ltd.,**
**Wortley, LEEDS.**
LONDON OFFICES & DEPÔTS:
**Baltic Wharf, Waterloo Bridge, S.E.**
**and G.N. Goods Yard, King's Cross, N.**
**Liverpool: Leeds Street.**
**Leeds: Queen Street.**
**Machine-Made Retorts**
Have been made in large quantities for the last twenty years; and during the whole of that time have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
*Retorts carefully Packed for Export.*
**Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.**

GAS
THE WINSTANLEY SPECIALTY COY.
ENGINEERS

## GAS ENGINEERS.
CONTRACTORS FOR, AND ERECTORS OF, ALL GAS-WORKS PLANT.
## REGENERATORS, GENERATORS, AND DIRECT-FIRED RETORTS.
RESULTS GUARANTEED.
COMPLETE INSTALLATIONS OF HORIZONTAL AND INCLINED RETORTS.
*ADDRESS—*
NEWTON CHAMBERS, CANNON ST., **BIRMINGHAM.**

**BOWENS' Ltd. Successors,**
**STOURBRIDGE.**

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS LUMPS, TILES, &c., of every description.
ESTABLISHED 1860.

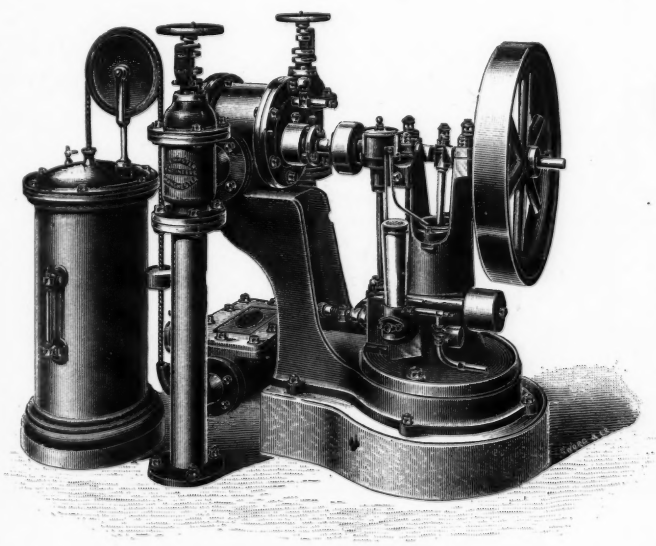
**CLAYTON SON & Co LTD**
**LEEDS**
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD ALSO
THE ORIGINAL MAKERS OF
**SPIRAL GUIDED GASHOLDERS**
MAKERS OF ALL KINDS OF
STRUCTURAL IRON & STEEL WORK. STEEL FRAMED BUILDINGS
ROOFS RETORT FITTINGS
PURIFIERS RETORT LIDS
ANTIFREEZERS for Gasholders
**STEEL TANKS**
OF ALL SIZES
MAKERS OF THE LARGEST IN THE WORLD.
**GASHOLDERS**
OF EVERY DESCRIPTION & SIZE.
HIGH CLASS BOILERS FITTED WITH DEIGHTON'S PATENT CORRUGATED FLUES.
Telegrams "GAS LEEDS." London Office 60 Queen Victoria St E.C.

**MANNESMANN**

**LAMP POSTS**
made throughout of
WELDLESS STEEL TUBING
including base, ring, and ladder rest
*Light, Strong, Unbreakable, and Cheap.*
GAS, WATER, & STEAM TUBES AND FITTINGS.
WELDLESS STEEL SPIGOT & FAUCET PIPES for Gas and Water Mains.
Tubes can be supplied up to 10 inches diameter and in lengths up to 30 feet.
**THE BRITISH MANNESMANN TUBE COMPANY, LTD.,**
*Landore, South Wales.*
*Birmingham Depôt:* 110, COLMORE ROW.
*London Office:* 110, CANNON STREET, E.C.

**R. & J. DEMPSTER, LIMITED,**
**MANCHESTER.**

Telegraphic Address: "SCRUBBER, MANCHESTER."
National Telephone Nos. 54 and 2296.



COMBINED ROTARY
**Exhausters & Gas-Engines**
FOR
**SMALL GAS-WORKS.**

10 to 15 per cent. increased yield per ton of Coal Carbonized.
Cost repaid in 2 to 3 Years.
Size of building 10 ft. square inside.
Capacities 500 to 6000 cubic feet per hour.

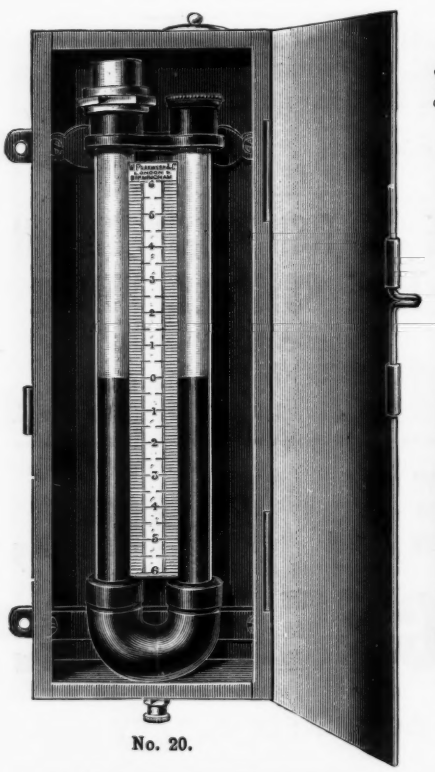
*Full Particulars and Quotation on Application.*

**London Office: 165, GRESHAM HOUSE, OLD BROAD ST., E.C.**

# PARKINSON'S

## PRESSURE AND VACUUM GAUGES.

The following engravings show a variety of Gauges adapted for different positions on a Gas-Works. The mountings are either of white metal, brass, or gun metal. We pay the greatest attention both to the finish of the mountings and to the selection of the glass tubes used, while every gauge is thoroughly tested for soundness before leaving our works.



No. 20.

Fig. 2.

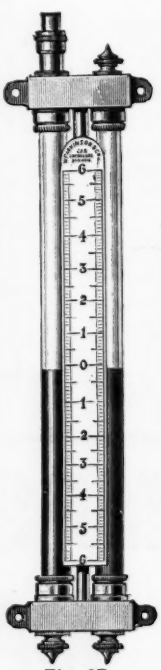


Fig. 3B.

Fig. 1.

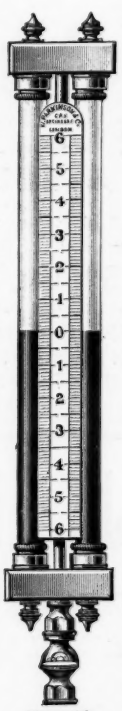


Fig. 5B.

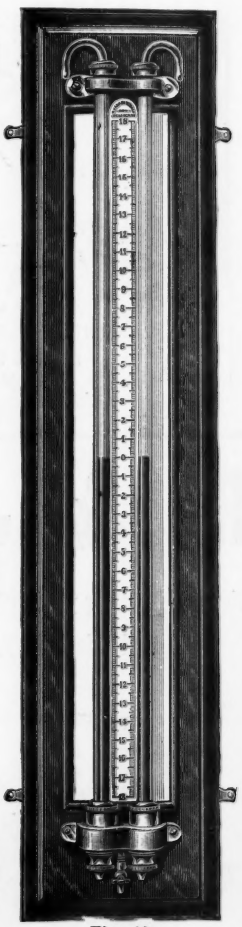
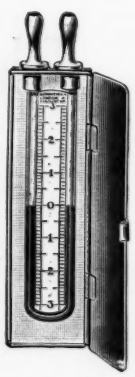


Fig. 10.



No. 30.

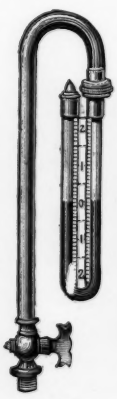
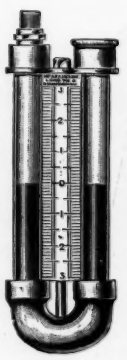


Fig 6.



No. 28.

Fig. 9.

PARKINSON AND W. & B. COWAN, LTD.,
*(Parkinson Branch)*

COTTAGE LANE, CITY ROAD, LONDON. | BELL BARN ROAD, BIRMINGHAM.

[See also Advt. p. 658.


Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Sept. 15, 1903.